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Maintenance Section
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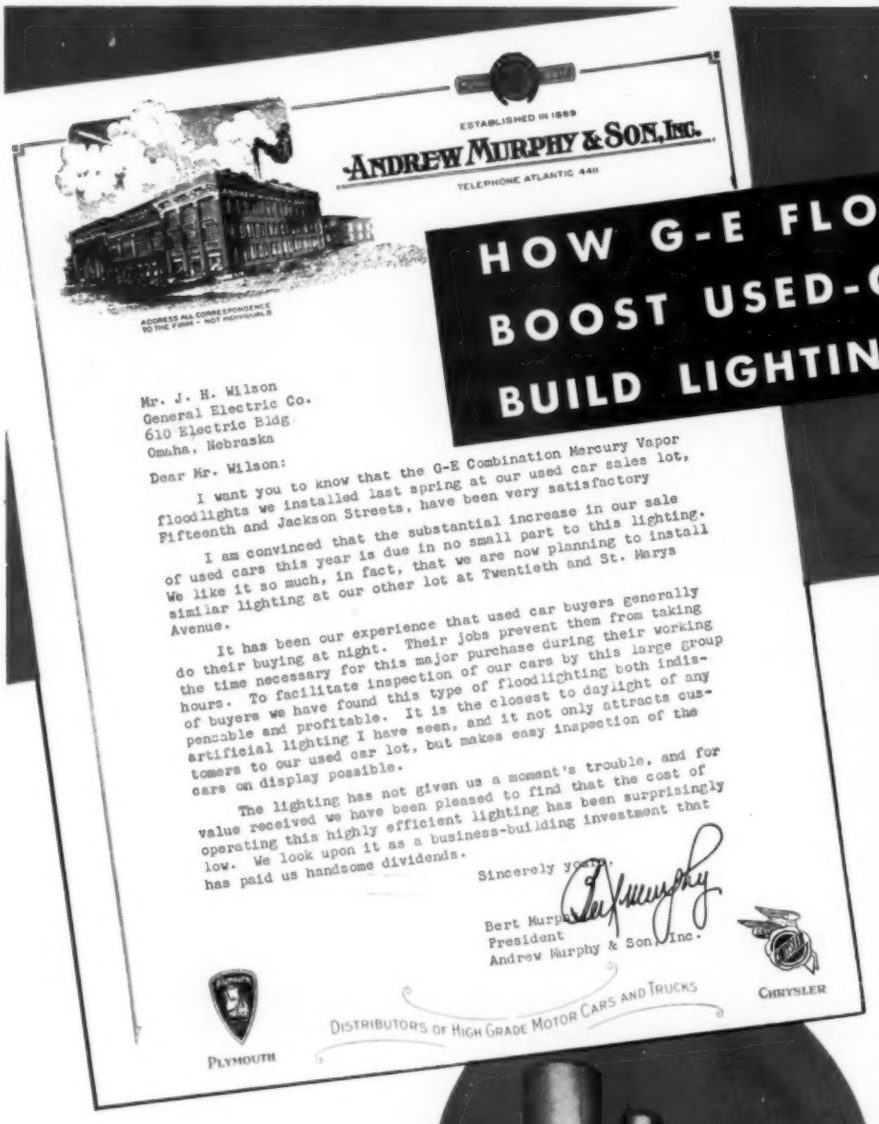
HOW G-E FLOODLIGHTS BOOST USED-CAR SALES, BUILD LIGHTING BUSINESS



ESTABLISHED IN 1889

ANDREW MURPHY & SON, INC.

TELEPHONE ATLANTIC 4411

ADDRESS ALL CORRESPONDENCE TO THE FIRM - NOT INDIVIDUALS

Mr. J. H. Wilson
General Electric Co.
610 Electric Bldg
Omaha, Nebraska

Dear Mr. Wilson:

I want you to know that the G-E Combination Mercury Vapor floodlights we installed last spring at our used car sales lot, Fifteenth and Jackson Streets, have been very satisfactory

I am convinced that the substantial increase in our sale of used cars this year is due in no small part to this lighting. We like it so much, in fact, that we are now planning to install similar lighting at our other lot at Twentieth and St. Marys Avenue.

It has been our experience that used car buyers generally do their buying at night. Their jobs prevent them from taking the time necessary for this major purchase during their working hours. To facilitate inspection of our cars by this large group of buyers we have found this type of floodlighting both indispensable and profitable. It is the closest to daylight of any artificial lighting I have seen, and it not only attracts customers to our used car lot, but makes easy inspection of the cars on display possible.

The lighting has not given us a moment's trouble, and for value received we have been pleased to find that the cost of operating this highly efficient lighting has been surprisingly low. We look upon it as a business-building investment that has paid us handsome dividends.

Sincerely yours,

Bert Murphy
President
Andrew Murphy & Son, Inc.

PLYMOUTH

DISTRIBUTORS OF HIGH GRADE MOTOR CARS AND TRUCKS

CHRYSLER

G-E MERCURY-INCANDESCENT floodlighting was a major factor in increasing the 1938 sales of Andrew Murphy and Son, Inc., Omaha, at its used-car lot. Mr. Bert Murphy, President, says, "We look upon it as a business-building investment that has paid us handsome dividends." Moreover, Mr. Murphy plans to floodlight another used-car lot with the same type of equipment.

If you use G-E floodlights, your customers, too, will be enthusiastic about their floodlighting. G-E floodlights are easy to install and to adjust; their sturdy construction assures long operation; and their neat, trim appearance makes them unobtrusive by day as well as useful at night. Try General Electric floodlights on your next job to gain the customer approval that brings more business. For further particulars write for a copy of our new catalog, "Novalux Floodlights." The coupon is for your convenience. General Electric, Schenectady, N. Y.

Type L40 mercury-incandescent floodlight

General Electric mercury-incandescent floodlights have won the approval of Mr. Bert Murphy for their illumination of the company's used-car lot

GENERAL ELECTRIC

General Electric
Dept. 6B-201
Schenectady, N. Y.

Please send me a copy of your new floodlighting catalog, "Novalux Floodlights" (GEA-1865C)

Name .....

Street .....

City ..... *State* .....

500-350

Easy to install

THIS New service and range SWITCH

It's BAKELITE

—*and just about*

FOOLPROOF

Yes Sir! Foolproof both in installation and operation—this Murray Combination Main and Range Switch with four Lighting Circuits and three wire tap for Water Heater.

The neat, compact Bakelite fuse pullers are deliberately *not* interchangeable. They are so made—and so marked—that mere reversal of either, top for bottom, gives complete contact, or none at all, as desired. There's no guess work about that.

Box—long-lived aluminum finish on steel. Mounts of Bakelite.

See how clearly marked the non-interchangeable fuse pullers are. Mistakes just *cannot* happen.

Why contractors prefer it . . . .

All you need do is hang the box, make your choice of knockouts, and connect the line through solderless connectors. Note, particularly, that the inside connections consist of heavy bar stock—all in full view and easy to get at. No other switch made is so easy to install.

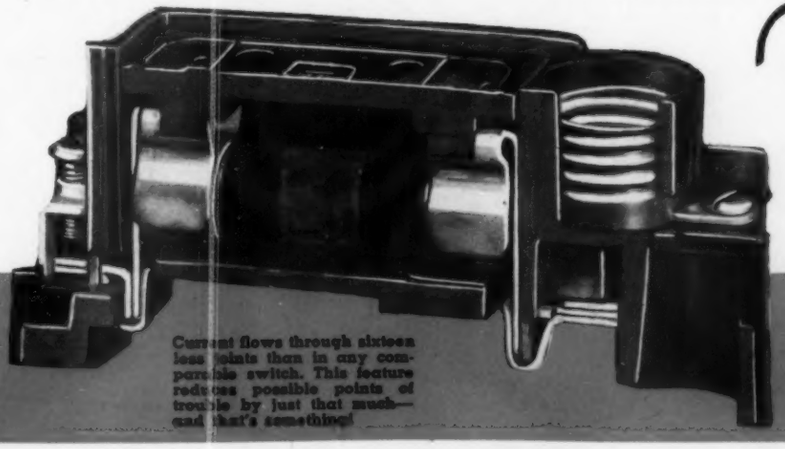
There's PROFIT aplenty, thanks to this quicker, easier installation. Ask us—or your jobber—for prices.

CATALOG No. 74-4

60 amp. 125-250 volts, 3 pole Combination Main and Range Switch, 4 Lighting Circuits and Water Tap.

CATALOG No. 77-4

Similar to 74-4, except Range Circuit independent of Main and Branches.



Current flows through sixteen less points than in any comparable switch. This feature reduces possible points of trouble by just that much—and that's something!

Murray SWITCHES

COLT NEWS

COLT ANNOUNCES THEIR NEW MULTI-BREAKER LOAD CENTERS

Famous Electrical Line Now Includes Latest Protective Devices for the Modern Home

Right up to the minute is this new Colt line of protective devices . . . the Colt Multi-Breaker. Modern homemakers demand finger-tip control of lighting circuits, electrical appliance, refrigerator and range circuits. That's exactly what the Colt Multi-Breaker provides . . . quick, handy, efficient "on" and "off" control for every circuit in the home.

Attractive cabinets and smart, moulded jet-black handles harmonize with today's kitchens . . . add a touch of efficiency to every home.

The simplicity of the Colt Multi-Breaker will appeal to your customers . . . especially the women. Absolutely safe . . . completely automatic in opening circuits when overload or short circuit occurs . . . and non-tamperable.

Here is the Modern Way To Protect A Modern Home . . . with a device that will win you new customers . . . greater wiring profits.

New Product Sure to Boost Electrical Business

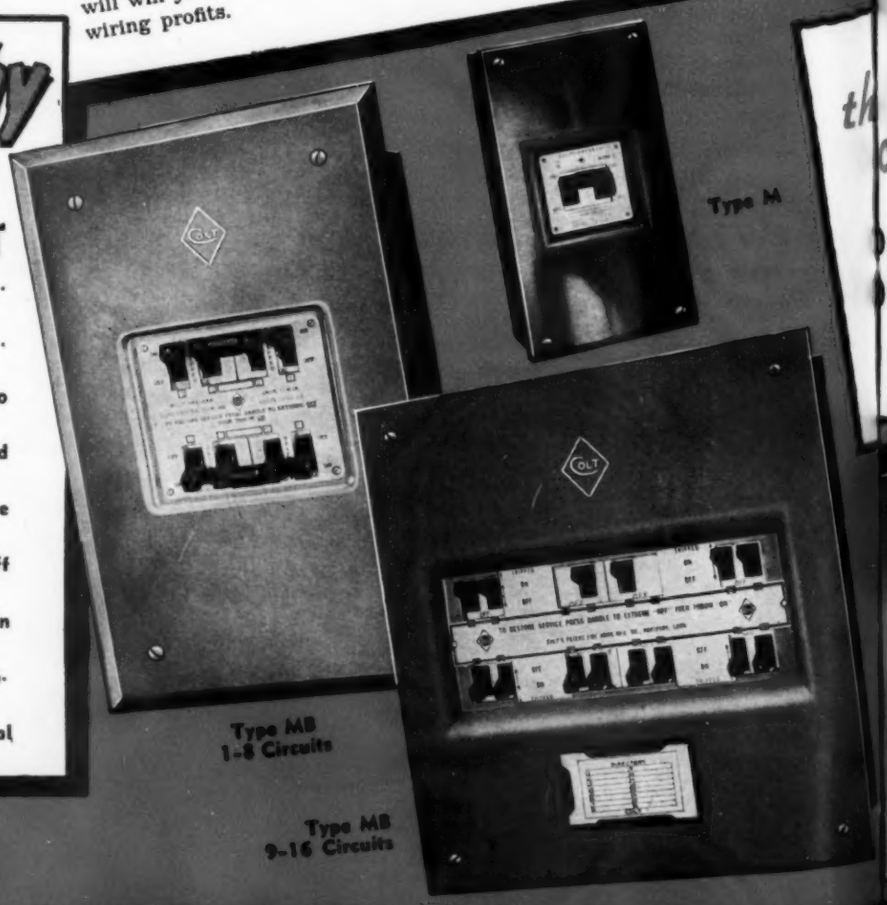
The latest announcement by the makers of the famous Colt line of electrical products is of special interest to every contractor . . . and every supplier of electrical equipment for new and reconditioned homes.

The New Colt Multi-Breaker has been announced at an opportune time when small homes are being built in large numbers . . . homes that will boast of one more sales feature when they are equipped with the up-to-the-minute Colt Multi-Breaker.

They sell easy . . . they install easy . . . they build business quickly and profitably.

9 Reasons Why you should install the COLT Multi-Breaker

1. They offer you a new source of profits . . . especially in the small home field.
2. They are quick and simple to install . . . minimizing wiring costs.
3. A wide range of models and combinations to meet almost any requirement.
4. Absolutely safe to operate . . . all parts sealed at factory.
5. Non-tamperable . . . impossible to over-fuse or bridge fuses.
6. Entirely automatic in operation . . . trip off when short circuit or overload occurs.
7. Provide finger-tip control of every circuit in the home.
8. No more expensive than ordinary fuse protection.
9. They spell PROFITS for YOU . . . in capital letters!



COLT *Multi-Breaker*

Complete Line of Types M..MB..MBM Now Ready

Available for 1 to 16 Circuits

Breaker Ratings 15 to 50 Amperes

New and bigger sales . . . an entirely new field opens up for you with the new Colt Multi-Breaker. The modern home builder knows what he wants in the way of electrical equipment . . . and he wants automatic, finger-tip control of his home circuits. That means he wants Colt Multi-Breaker . . . and that means bigger sales, more profits for you. These new Colt devices are as modern as tomorrow. The line is complete . . . ranging from the compact type "M" up to the sixteen circuit type "MB" and the combinations known as type "MBM".

EASY TO SELL...
and EASY to Install

Nothing could be simpler than these new Colt Multi-Breakers. Simple in design . . . easy to explain to prospects . . . quick to install . . . attractive in appearance. Their features will sell them almost on sight. We have prepared detailed data on this new Colt line. It's yours for the asking. Just clip the coupon below. It will bring you a complete 16-page illustrated catalog. Includes prices . . . dimensions . . . wiring suggestions . . . and a full description of this modern profit-building line of Colt Multi-Breakers. Right now — send in the coupon.

Clip THIS COUPON and return it right now for complete data on this new line . . . IT WILL MEAN REAL PROFITS FOR YOU!

Yes Sir!

I want full data on your NEW COLT MULTI-BREAKER. Send detailed information on all models, including prices.

COMPANY _____

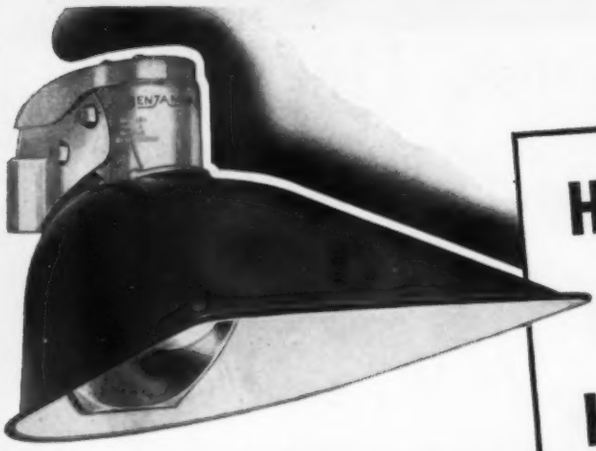
ST. & NO. _____ STATE _____

CITY _____

BY _____

COLT'S PATENT FIRE ARMS MFG. CO.
Electrical Division Hartford, Conn.

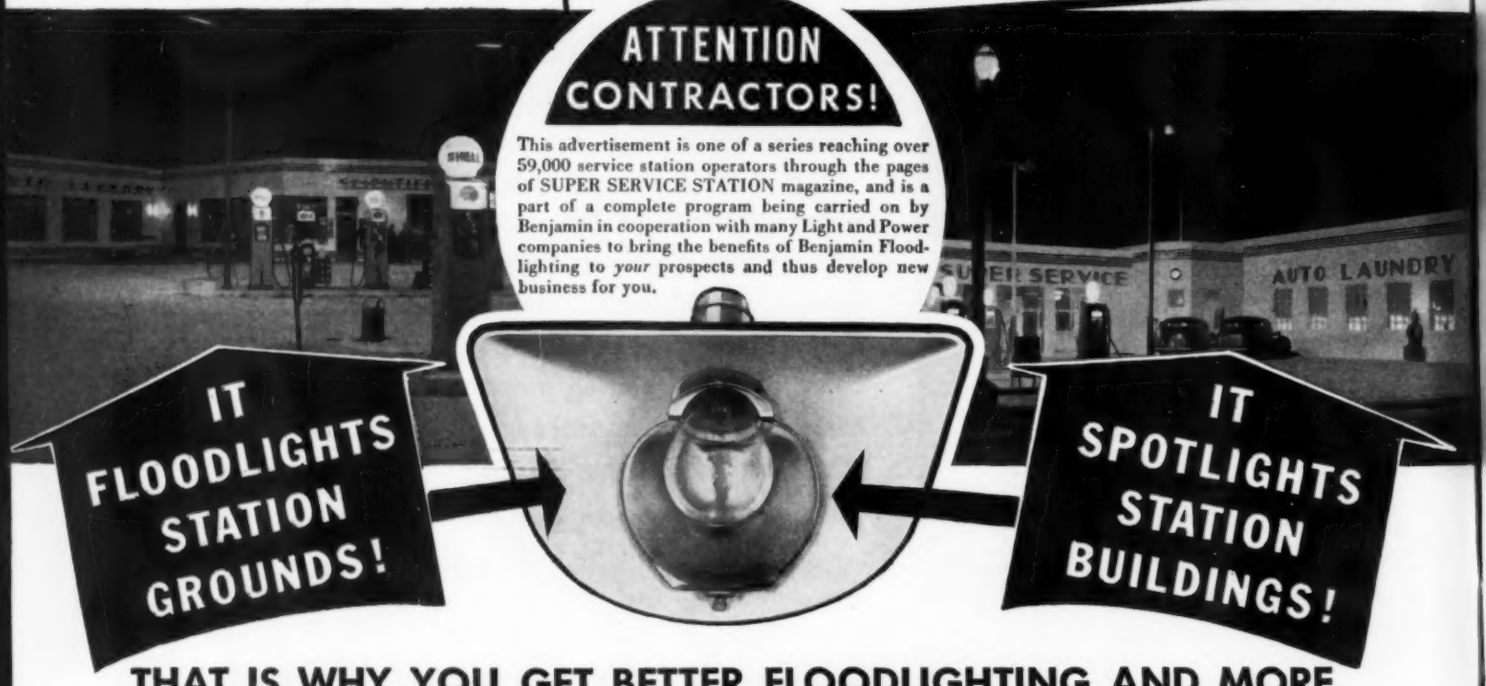
...OAD CENTERS



HOW THE BENJAMIN *Original* 2 *in* 1 DUO-SERVICE FLOODLIGHT HELPS ATTRACT MORE TRADE!

ATTENTION CONTRACTORS!

This advertisement is one of a series reaching over 59,000 service station operators through the pages of SUPER SERVICE STATION magazine, and is a part of a complete program being carried on by Benjamin in cooperation with many Light and Power companies to bring the benefits of Benjamin Floodlighting to *your* prospects and thus develop new business for you.



THAT IS WHY YOU GET BETTER FLOODLIGHTING AND MORE FOR YOUR MONEY FROM THIS DOUBLE-DUTY FLOODLIGHT!

With Benjamin Duo-Service Floodlights every lamp does double-duty in making your station more attractive to motorists. From these Floodlights you get the two kinds of lighting you need to make your station and grounds *stand out at night* from their surroundings and attract more trade—the kind of lighting you need to make sure your station KEEPS AHEAD OF COMPETITION!

That is why nearly 20,000 stations use Benjamin Duo-Service Floodlighting. That is why stations report sales increases of from 25% to 400% after installing Benjamin Duo-Service Floodlighting. Yet these double-duty, porcelain enameled, weather-resisting, high efficiency floodlights cost no more than conventional floodlights. So why be satisfied with anything less than their 2 in 1 lighting advantages?

NOW DUO-SERVICE FLOODLIGHTS AVAILABLE FOR THE NEW BI-POST 1000 WATT LAMPS

These new lamps are not affected by rain or snow, being made with a new hard glass especially suitable for outdoor service. Duo-Service Floodlights may be secured with special sockets required for these lamps at slight extra cost.

INSIST ON DUO-SERVICE FLOODLIGHTING TO GET NEW CUSTOMERS AND HOLD OLD ONES! The most profitable investment you can make to increase both night and day business is to bring your floodlighting up-to-date. To make sure your lighting is up to 1939 standards, call on your local electrical contractor or light company or the Benjamin Electric Mfg. Co., Des Plaines, Illinois, and say "I want a

FREE LIGHTING CHECKUP." Also ask for copies of free booklets entitled "What Every Service Station Operator Should Know About Lighting" and "Proof of Increased Trade and Gallonage Through Benjamin Floodlighting."

It Pays to Insist On BENJAMIN TRADE MARK DUO-SERVICE FLOODLIGHTS

DISTRIBUTED EXCLUSIVELY THROUGH ELECTRICAL WHOLESALERS

electrical contracting

With which is consolidated The Electragist and Electrical Record
Established 1901

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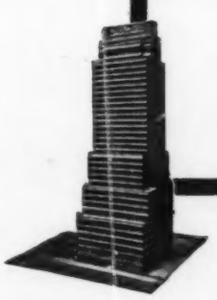

A SERVICE PAPER for electrical contractors, engineers, motor shops, industrial electricians and inspectors, covering engineering, installation, repairing, maintenance and management, in the field of electrical construction—industrial, commercial, and residential.

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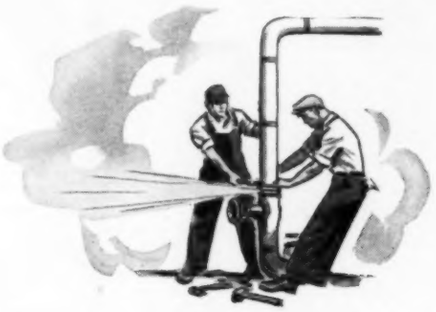
Make it happen to you!

Contractor shows concern how to cut power losses $100 monthly

Reward: Complete rewiring job!

Ashton B. Taylor, President, Burlington Electric Motor Service, Inc., Winooski, Vt.

"AS a result of overhauling the electric motors and rewiring the power circuits, we gave a creamery in our vicinity not only uninterrupted service from their motors, but reduced power losses to a point where actual savings of $100 a month were made. Needless to say, this work involved a nice profit for my company. It taught me that electrical modernization is a big field offering tremendous possibilities to the electrical contractor"—reports Mr. Taylor, whose firm repaired the circuits with modern, improved Anaconda wire and cable.



They fix the leaks they see—show them how to fix their invisible leaks

Current waste isn't easy to detect—that is, not for the nine out of ten plants that estimates show are suffering important power losses from old-fashioned, outworn circuits. But, for you—that's different. You have the equipment and the experience to show where overloading is causing heat losses—where power is "evaporating" invisibly. Use that equipment and experience just as Mr. Taylor did. Instead of small repair work, you'll be getting profitable three- and four-figure modernization jobs.

ANACONDA
from mine to consumer

39318

Your Anaconda distributor will help you

Contractors everywhere are finding that it pays to solicit industrial modernization contracts. Now is the time to plan your sales activities so as to reduce "repair work" and build up modernization. The material you need to develop industrial wiring is available without cost. See your local Anaconda distributor for complete sales plan and copies of the "Wiring Survey" booklet.

ANACONDA VARNISHED CAMBRIC CABLE

Anaconda Varnished Cambric Cable. One of the time-proven Anaconda industrial wiring products. Write for booklet describing this improved cable.

USE MODERN IMPROVED *Anaconda Wire & Cable*

ANACONDA WIRE & CABLE COMPANY • General Offices: 25 Broadway, New York City • Chicago Office: 20 North Wacker Drive

Subsidiary of Anaconda Copper Mining Company • Sales offices in principal cities

electrical contracting

JUNE, 1939

Why Not?

NOT LONG AGO, the Dupont Company pulled a bit of whimsey on the well known pig. Out of their research laboratory, they produced synthetic bristles that any fat porker would admire to wear. And they put 'em into brushes of many kinds.

WELL, ORDERS CAME POURING IN from Turkey, India and the South Mediterranean, where the Mohammedan peoples live. To them the pig is unclean—and all his parts. They wanted "Duprene" tooth brushes quick. For at last they could brush their teeth!

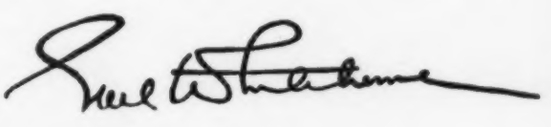
IT WAS A BIG SURPRISE to Dupont. They did not know the children of Allah longed to indulge in this dental diversion of the unbelievers. But there you are—as Caesar used to say.

AND THIS IS TYPICAL of our modern world. We are so highly specialized today that on all sides of us are problems, needs, desires that we don't know about. Yet any one of them may offer the electrical contractor some new market, some new opportunity.

DUPONT DID NOT REALIZE what was on the Mohammedan's mind. And likewise we don't know what textile men may want right now or paper mills, or candy factories or machine shops or those who process foods. They work as much apart from us as the followers of the Prophet.

BUT WE DO KNOW that under present economic pressures there is incessant change throughout all industry and business. Prices rise and fall. Markets wax and wane. Processes and products are constantly being improved. From every side the cry is—"How can we cut costs and do a better job?"

WE HAVE THE ANSWER. In terms of light, heat, power, control, communication we hold the keys to progress and prosperity for many of our local industries. Only we don't heed their cries! We don't send out our tooth brushes for them to see! Why not?



EVERY GRAYBAR SALESMAN has a "BACKER-UPPER"

. . . . to help you get better service

A two-man team handles your account when you do business with Graybar.

One man—the salesman—calls on you. The other—your *service man*—sits close to a phone at our warehouse and backs up the salesman. The service man handles your orders—answers telephone inquiries—is thoroughly familiar with your needs.

Result—you get quicker, better service. When you need something in a hurry a man who knows your needs sees that you get what you want—when and how you want it. *You* save time and energy.

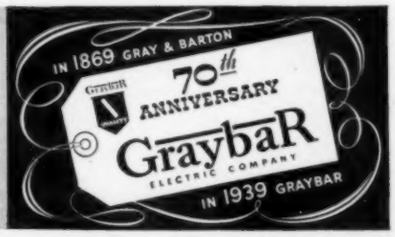
This is one of the many extra values your dollar buys when you deal with Graybar.

Ample Graybar stocks at a nearby warehouse are keyed to Contractors' needs. *Action Service* by speedy delivery—or at convenient pick-up counters . . . makes these products quickly available. And Graybar's guarantee backs you up on every job where you use our materials.

Naturally, you want to get the utmost in *value* for every dollar you spend for electrical products. You get just that when you buy from Graybar. Call on Graybar . . . for everything.

TOOLS • WIRE AND CONDUIT • TAPE • WIRING DEVICES • LIGHTING • MOTORS

OFFICES IN 83 PRINCIPAL CITIES • EXECUTIVE OFFICES, GRAYBAR BUILDING, N. Y.



FLEXIBLE POWER facilities *are available, whatever the machine layout, by making short connections from ceiling bus to groups of motors*

An ALL-BUS Distribution

This Brooklyn manufacturing plant needed flexible power distribution. The use of an extensive bus system provided the answer.

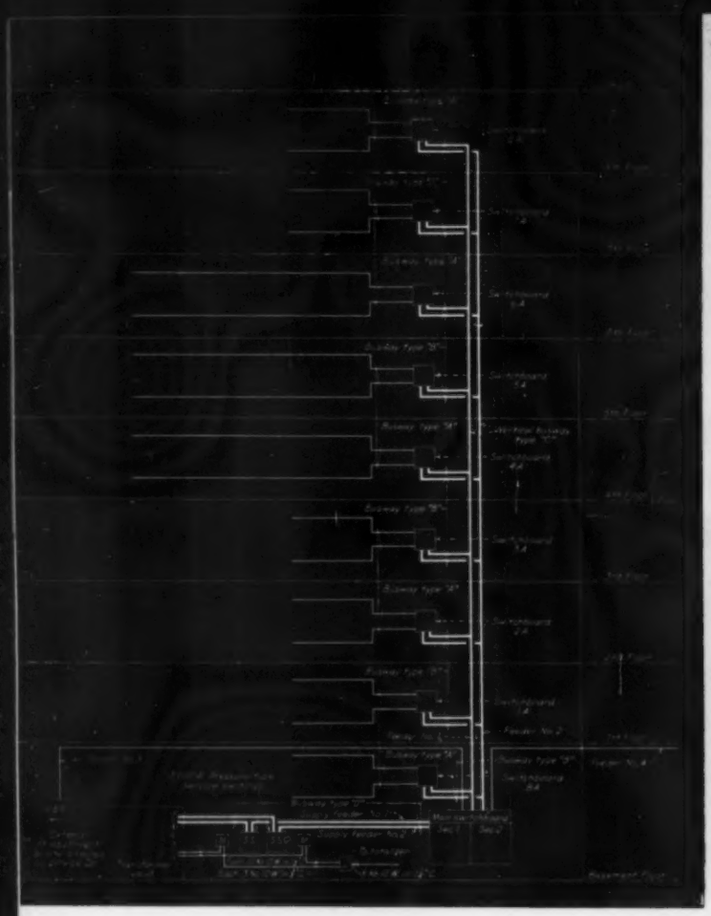
A NEW 8-story building recently completed for the American Safety Razor Corporation in Brooklyn provides an example of the use of bus bars in electrical distribution planned to meet variable and heavy-duty requirements. It is a notable case of industrial adequacy designed in tune with modern production methods and the present-day tendency to make frequent changes in loads and machinery layouts.

This company's plant comprises a number of building units which house equipment for making safety razors, electric shavers, shaving brushes and other products. About 1330 motors are used, also numerous portable tools and other electrically heated apparatus. A new building was recently constructed adjacent to the largest existing unit to permit a gradual expansion in production facilities. So this last unit required an electrical distribution system which could accommodate whatever departments were moved into it. But no attempt was made to provide for any particular layout of machinery. The new system had to be flexible as to load requirements and ready for the final location of the equipment.

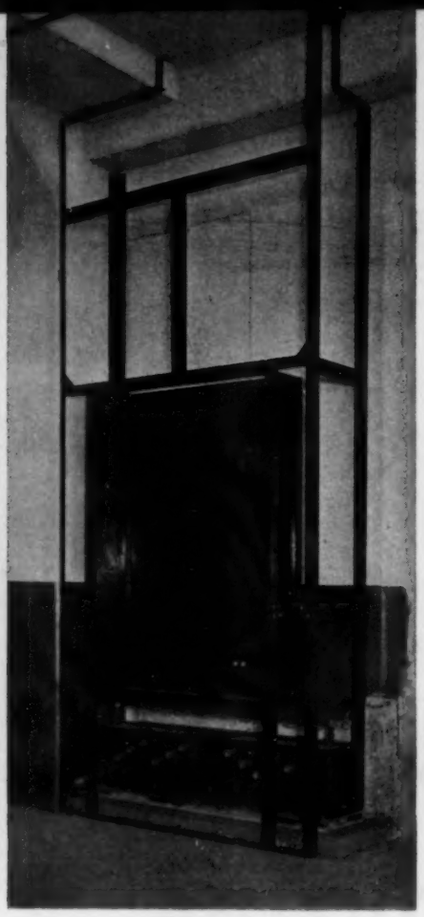
The problems involved in this program were overcome by adopting an interesting installation of copper bus bar feeders and distribution serving all production areas on nine floors. Essential elements are twin bus bar feeders and risers, load transfer switches on all floors, and extensive plug-in bus distribution that simplifies connections for future machine arrangements. This work was installed by Hatzel & Buehler Inc. of New York City.

With a total area of about 139,000 square feet of the nine floors, this building has two bus bar feeders of 3000 amps. each, supplying 3 phase 4-wire 120/208 volt current. These feeders were extended to the top floor without reduction in capacity. They supply power to about 2200 lineal feet of Trumbull "Flex-A-Power" bus bar distribution, which is run along the ceilings of all floors. Two or more runs were installed on each floor to serve the various machinery areas. These runs are all 375 amp. capacity and provide 3 phase 4-wire connections for lights, heating devices or motors. With this extensive network of decentralized bus distribution, no panelboards were employed for the general manufacturing areas.

INDUSTRIAL ADEQUACY *was provided for future electrical loads when this plant added a new building unit (Turner Construction Co. photo)*



ALL-BUS DISTRIBUTION *riser layout provides industrial adequacy on nine floors adequate for years to come*



SUSPENDED COPPER *risers terminate at the 8th floor transfer panel in copper cross bars brazed to vertical busses*

BRAZED JOINTS *in 20-ft. lengths of riser bus bar eliminate all contact worries and save lap waste. Cable taps are brazed to riser bus*

In designing this system, the consulting engineers, Tenney & Ohmes, Inc., specified these advantages for future operations:

1. Dual main feeders to serve all floors at full capacity, thus absorbing the diversity should heavy increases in load occur on several floors.

2. Load balancing facilities for every floor to permit the transfer of bus distribution feeders to operate from either main riser.

3. In case of main feeder trouble, any desired combination of floor feeders up to 3,000 amps. total load to be transferable to one main riser bus while the other is out of service.

4. All floors to be provided with connections for serving three runs of bus distribution, for making future machine hookups with a minimum length of exposed circuit wiring.

The duplicate main feeders are run side by side from the service switch to the top floor. These comprise in all twenty four ¼-in. by 3-in. phase bars and four ¼-in. by 2-in. neutral bars. These main runs represent a total weight of 16,500 pounds of assembled copper. The arrangement of bars employed four per phase in each feeder. These were laminated in pairs, making two parallel legs per phase. The neutral for each feeder employed two ¼-in. by 2 in. bars.

Expansion and contraction due to variations in bus temperature prompted several precautions. The first step was to braze all joints instead of clamping. To minimize the amount of brazing required, bus bars were ordered in 20-ft. lengths. Since previous tests proved the strength of brazed joints, only a ¼-inch lap was necessary. This reduced the normal waste in copper for lap contact area. (The details of brazing copper bus bars as performed by Hatzel & Buehler, Inc., were covered in *Electrical Contracting,* November 1937 issue.)

To take care of expansion in the vertical risers, these bus bars were suspended from the eighth floor. It was done by brazing T-shaped ends on all riser bars, so that they rest upon floor-supported insulating blocks. This novel arrangement allows free bus expansion toward the basement under varying temperatures. Intermediate alignment blocks of ebonized asbestos were provided for the 8-story riser height of these buses. These occur usually from 40 to 48 inches apart, and tend to lend some strain relief to the upper suspension method.

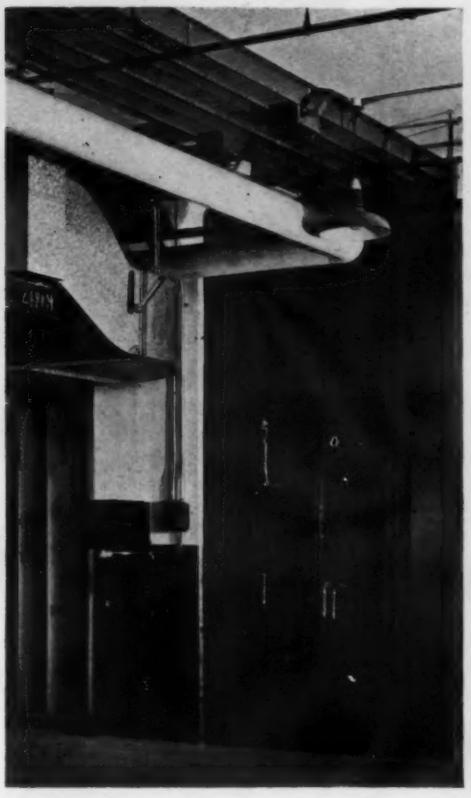
At each floor there is an enclosed switchboard which controls taps taken from the two risers. Each board has three 400 amp., 3-pole, double-throw switches for controlling three runs of horizontal distribution bus serving that floor. Flexible cable connections are made to the 3,000-amp. riser buses "A" and "B" for feeding opposite ends of these switches. Thus each run of distribution bus may be transferred to either riser to facilitate equalized loading of the mains. The lugs for all cables connected to riser buses were brazed in place between bar laminations.

The layout anticipates the use of three lines of "Flex-A-Power" bus distribution per floor. Provisions were made on the basis of a 375 amp. 4-wire maximum future load. This is based on past experience in the other buildings, and the probable density of production machinery required.

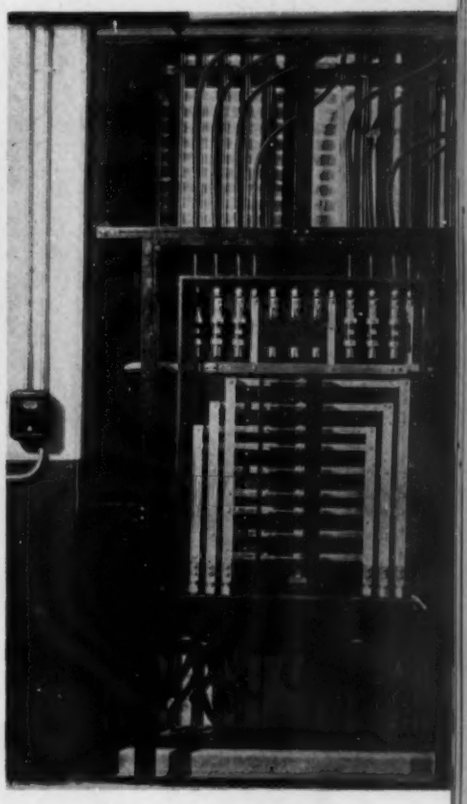
As production areas become filled with smaller machines, these are connected by means of sub-feeders, instead of using a separate plug device on the

TWIN SERVICES *of 3000-amp. capacity each require two runs of busway covered with insulating board*

FEEDING OUT *from the riser point and transfer switches, three runs of 375-amp distribution bus serve the load on this floor*



TYPICAL ASSEMBLY *of transfer switch panel in front of 3000-amp riser busses. Cable connections give to bus expansion*



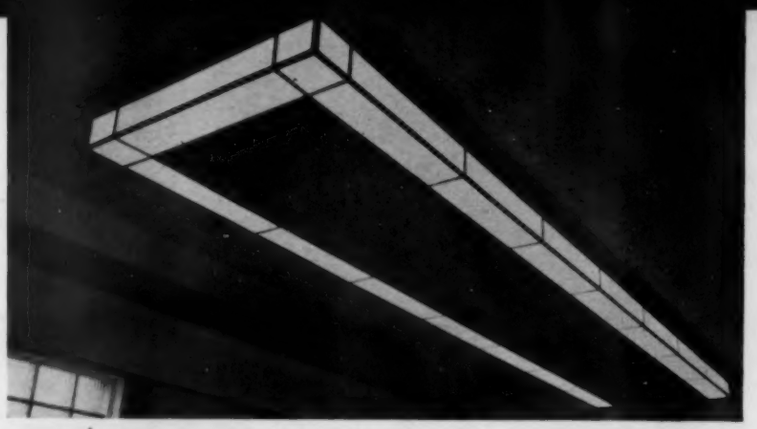
bus system for every motor. The usual practice is to install a 60-amp. plug and extend a sub-feeder to a fuse cabinet located above several machines. Separate motor branch circuits of smaller wire are installed from this fuse box to the individual motors. This arrangement reduces the number of plug devices placed on the bus system. It likewise reduces the number of exposed conduits that would need to be run from individual motors to the overhead bus.

The method of lighting distribution employs three-phase, four-wire branch circuits. These circuits usually serve three outlets of 200-watts rating per phase, making nine lighting outlets per four-wire circuit. The layout was arranged for these circuits to be connected to the bus distribution runs in a uniform arrangement of conduit routings within bays. Each bus connection or "Flex-A-Plug" is a 3-pole, 30-amp fusible device, with common neutral tap. To simplify future maintenance, all circuits employ color coded wire—yellow, red, black for phases and white for the neutral conductor.

Since there are no lighting panelboards, most lights are individually controlled with pull switches. This is considered an advantage, because switching and circuit maintenance from a panelboard often results in unintentionally switching off circuits serving other areas.

Here then is one of the latest examples of distribution engineering for a multi-story factory building. Future growth in load has been liberally provided for in a way that reduces disturbance to operations, while also providing economical means of changing the plant's machinery layout.

LIGHTING DISTRIBUTION *is decentralized by running 3-phase 4-wire branch circuits to bay rows from plug devices at shortest possible point*



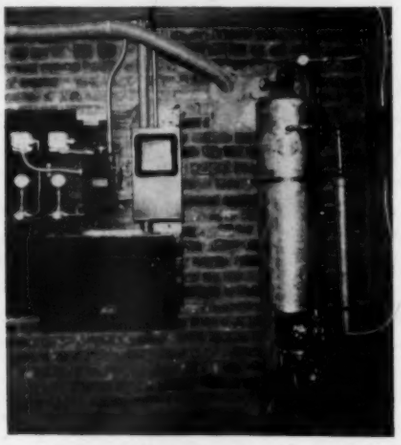
MAIN STUDIO "A" *adjoins this large acoustically-treated viewing room. The light source is from 86 lights within a suspended luminous glass fixture measuring 18 ft. 6 in. long and 3 ft. 6 in. wide. Corner outlets have 50-watt lamps, others are 25-watt. There are five fixtures of this type.*

FIXTURE ASSEMBLY *combined the work of electrical, acoustical and heating system mechanics. First electrical workers suspended the fixtures by ½-in. ceiling bolts, then they were electrically connected and adjusted to heating and air conditioning ducts that are stubbed down from the ceiling. Finish work consists of lamping up, installing glass panels and sections of acoustical material in the bottom.*

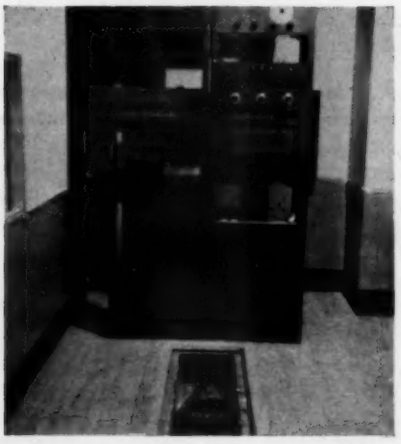
Make-Ready for BROADCASTS

Some electrical details in converting Richmond offices to radio studios

DISTRIBUTION *was badly needed for the building, and the new studios caused replacement of an inadequate layout with heavier feeders and metering.*



COMFORT CONTROLS *for the studio's year-round weather systems start with the refrigeration equipment (left), and the compressor for air controls.*



CENTRAL CONTROL *rooms for studios adjoin this switchboard room. To simplify routing the radio and control circuits, a floor wireway was extended.*

RADIO entertainment brings people to local studios in increasing numbers to see their favorites in action. Broadcasters are therefore obligated to provide studios that are comfortable for artists and also accessible and equally comfortable for visiting fans. In Richmond, Va., new studios for station WRNL were recently completed in a small office building near the shopping center. Here Morris Hunter, local electrical contractor, has done a re-wiring job in connection with re-modeling space formerly used for offices.

The new lighting requirements in the relatively small area taken over, utilize a new 18-circuit panelboard. The main studio is provided with three No. 4's to a range outlet, for cooking schools. In addition there are microphone and clock outlets, exit lights and various operating signals. All conductors in the studios or within ten feet of their walls, are lead covered.

To take care of new lighting and the motor load for air circulation, winter heating, summer cooling and dehumidification required a complete modernization of the old entrance and distribution center.

The WRNL studios of the Richmond News-Leader will combine attractive design, comfortable quarters for artists and visitors and also technical broadcasting efficiency. Moreover the new load values which this conversion placed upon an existing system of wiring, pave the way for further modernization.

Your LEGAL RIGHTS

By Donald M. Wakefield
Legal Advisor to the Minnesota Electric Council, Inc.

Nine points of the law that bear upon the contractor's business as told to Minnesota contractors at the Mankato Convention

AS you know, every time an electrical contractor transacts any business, of course, he is entering into a legal relationship with some other person or organization. But seldom do you think of the effect of routine matters involved in the everyday business, upon your legal rights, should you be called upon to enforce them or defend them.

Yet this is vital if you would build a safe foundation for the enforcement of your rights. It consists of conducting your everyday business in such a way that, when it becomes necessary to enforce that which you believe to be your right, you will not only have the right but also the ability to enforce it. For example:

1. Before all else, of course, you must have enforceable right. The best way is to have definite agreements concerning all transactions of any importance and have them in writing.

2. Of equal importance is the matter of keeping complete and sufficiently detailed records, that will show how much time and how much material was furnished for each job, how much of each was furnished for the original job and how much for extras. And, if there are several distinct units to a particular installation, know just how much material and labor was furnished in completing each unit.

Reasonably detailed and accurate records are an absolute necessity in the winning of many kinds of actions. Even though you have an express contract to be paid by a certain sum, there are occasions when you must be able to show not only the contract price, but also the reasonable value of the labor, services and material which you furnished. This requires supporting information such as is shown on the usual job tickets, shop orders and time cards. The books and other records, to be admissable as evidence, must contain all the original entries for money paid and received, goods delivered, services performed and materials furnished.

3. Another important item is information about the person or firm with whom you are dealing. But many, while recognizing the need for credit information, still fall far short of obtaining the required amount. I have known of cases where work has been done and the contractor has made the charge in the name of a supposed "company" of some kind, omitting part of the actual name, never knowing whether the debtor was an individual, a partnership, a corporation or an association, and without questioning either the authority or the intention of the person ordering the work.

4. The right of lien is peculiar to the construction industry. Every contractor knows considerable about liens. But many contractors are of the opinion that merely because they furnish labor and material in the improvement of real estate they will, by that fact alone, have the right to establish a mechanic's lien. This is not true. The basis of a lien is the consent of the owner to the making of an improvement to real estate.

The consent of the owner may be either expressly given by the owner himself or it may be implied. The improvement may be authorized by an agent, trustee, contractor or subcontractor. The consent may be implied where the owner has knowledge that it is being made and does not deny liability; or where a necessary improvement is made without the knowledge of the owner but with the knowledge of an agent of the owner. But obviously it is better to make sure ahead of time that the owner has knowledge that the work is being done.

5. What is an improvement under the mechanic's lien statute? The general rule is that all improvements which are attached to and become a part of the real estate, are lienable in nature, and certain rules may be applied:

First, there must be some kind of annexation to the reality or to some structure thereon.

Second, the nature of the material must indicate that the improvement is to be considered a part of the realty.

Third, the adaptability of the improvement to the use to which the land is being put must show that the improvement is an aid to the use of the land.

(*Continued on page 72*)

FLUORESCENT CHANGEOVER — *Hickey Brothers, Davenport, Iowa, recently changed to fluorescent daylight. Speers Company, electrical contractors, designed an overall ceiling pattern with "CurtisStrip" and 36-inch lamps, and on wall cases 18-inch lamps. General lighting is 35 foot candles.*

Nine Points on Fluorescent Work

Like anything else, success in fluorescent lighting depends on the skill with which it is applied.

WITH the popularity of fluorescent tube lighting spreading over the country, the following hints may save some headaches. They were gathered from estimators and contractors who have had experience with installations of this new lighting.

1. *Don't skimp labor estimates.* With every contractor wanting to take a fling at fluorescent tube installation, there is too much guess work going on. With an almost unlimited market there is no excuse for contractors throwing away profits by gambling on installation costs. Several contractors report installation costs of approximately 2.5 m.h. per lamp on current jobs.

2. *Avoid home made reflectors.* The designing of reflecting equipment for fluorescent tubes is a nice problem in engineering. Light cannot be reflected back through the lamp, therefore, reflectors designed for clear lumiline lamps are not usually suitable for fluorescent. This has been generally recognized by manufacturers of fluorescent lighting equipment, but is usually ignored in home made reflectors.

3. *Allow for heat in auxiliaries.* In calculating heat thrown off from a fluorescent tube installation in an air conditioned room, it is necessary to allow for heat radiated by the reactor auxiliaries as well as the lamp. Tests have shown that approximately 10 per cent of the total wattage of the system is absorbed in the auxiliaries and that most of this energy is dispersed in the form of heat. While the heat given off is still very small compared with an incandescent lighting installation, fluorescent installations are not literally cold.

4. *Give more light.* Many contractors have been selling fluorescent installations as a means of reducing power bills. Some smart operators, however, are taking advantage of the "better light" publicity of recent years and are selling high illumination levels at "only a slight increase in current consumption".

5. *Check for radio interference.* Some fluorescent tube installations have caused a lot of noise in nearby radio receivers. Some circuit filtering may be necessary. When you run into trouble enlist the aid of your local utility radio interference expert.

6. *Don't overload wiring systems.* It is important to allow ample wattage capacity above the lamp rating for auxiliaries and low power factor. Auxiliary losses may be as high as 12½ per cent of the tube rating and power factors of 50 to 60 per cent may be expected. It is, of course, advisable to use high power factor type auxiliaries equipped with condensers, or a single condenser may be used to correct an entire circuit or group of circuits. The high light output per watt in fluorescent tube installations leaves no excuse for anything less than a thoroughly adequate wiring system.

7. *Use quality installation methods.* On 220 volt lamp installations, make sure that conduits and raceways are thoroughly grounded. To make doubly sure carry through the system an extra ground conductor (bare or green) solidly bonding all metal parts. Switches for such 220 volt circuits must be double pole (see article 2007, 1937 Code).

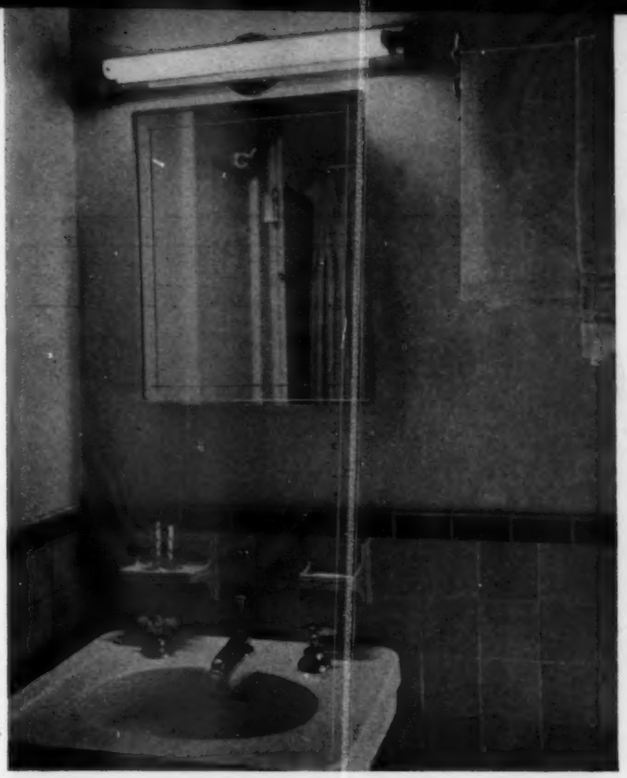
8. *Protect from weather.* The temperature of the tubes effects both starting and light output, so care and discretion in the use of lamps exposed to temperature variations or outdoor weather should be used.

9. *Don't try to do everything with fluorescent light.* While the potential market for fluorescent lighting has probably not yet been scratched, it is not a universal substitute for incandescent lighting. Fluorescent lamps cannot be used with dimmers. They are unsuitable for projection or similar uses requiring a highly concentrated light source. In some cases, they have been found too brilliant for such installations as movie theatre interiors, where widely distributed light at very low intensities is needed.

In a word, fluorescent lamps give the contractor a valuable new lighting tool. But it will win public acceptance only in direct proportion to the skill with which it is applied. So keep these nine points in mind.

FLUORESCENT on the MARCH...

A variety of recent installations that suggest the many ways in which this new tubular lamp can be applied.



MIRROR ILLUMINATION. Most hotel and home bathroom mirrors are lighted by a unit directly above. It doesn't provide the "under the chin" illumination which every shaver desires. With a 24-inch fluorescent lamp unit, the lighting is soft and comfortable, and, because the source is a long one, ample light is provided under the chin.

MATCHING PROOFS AGAINST ORIGINALS. These fluorescent lamps are used by the Crowell Publishing Company, Springfield, Ohio, to check color proofs against originals. There are forty-six 24-inch lamps in this installation and they provide 100 footcandles on the proof table. It is now possible to obtain high-level lighting of daylight color at reasonable cost—a new market for the electrical contractor.

LIGHTING A DRESS RACK. This installation is in the fashion floor of Kaufmann's, Pittsburgh. Fifty-eight daylight fluorescent lamps, four 12-inch, seven 24-inch, and forty-seven 36-inch lamps are employed. The lamps are used bare, the holders being merely screwed to wooden framework. They provide an average illumination of 137 footcandles at the dress shoulder. The general lighting is from 300-watt lamps in totally indirect equipment.

FLUORESCENT LIGHTED SHOWCASES. With the fluorescent lamps, twice as much illumination can be provided on displays without the cases getting any hotter than they now are when lighted with filament lamps. This is a major consideration in lighting confections or meat. This meat display in the Vittle Vendor Market, Oakland, is lighted to 100 footcandles by a line of 30-watt daylight fluorescent lamps.

These Inspectors Steer Them Right

ADEQUACY ASSURED—*These members of the Miami Beach, Florida, building department have found a way to enforce the architect's electrical layout.*

Miami Beach construction moves fast but wiring design keeps pace. Unique inspector-architect cooperation provides for safety and adequacy despite the rush.

THE electrical inspectors of Miami Beach, Florida, work on the theory that good electrical work requires a full and definite layout before bidders receive the plans. Jobs move swiftly in this fast-growing city, so there is little time to revamp improper layouts once work gets under way. So, the architect or consulting engineer must file with the city's electrical inspection department a certified statement of the connected electrical load, prior to the date of filing the complete general plans and specifications.

From this load data, the inspection department extends the values given and works out a design for metering and feeder distribution, and submits with it a specification to cover the details involved. This information is supplied to the architect free of charge, and is made a part of the general plans and specifications. The architect's certified statement of connected load, and the inspection department's layout developed therefrom cannot be changed later by the electrical contractor without authorization from the architect or owner.

Under this program the architect's general plans or specifications must contain an approved electrical design showing—

a. Service location, as designated by the power company.
b. Approved point of service.
c. Size of main switch.
d. Number of meters—number and size of meter switches.
e. Size of service entrance conductors.
f. Size of service entrance raceway.
g. Dimensions and location of areas provided for service and metering equipment.

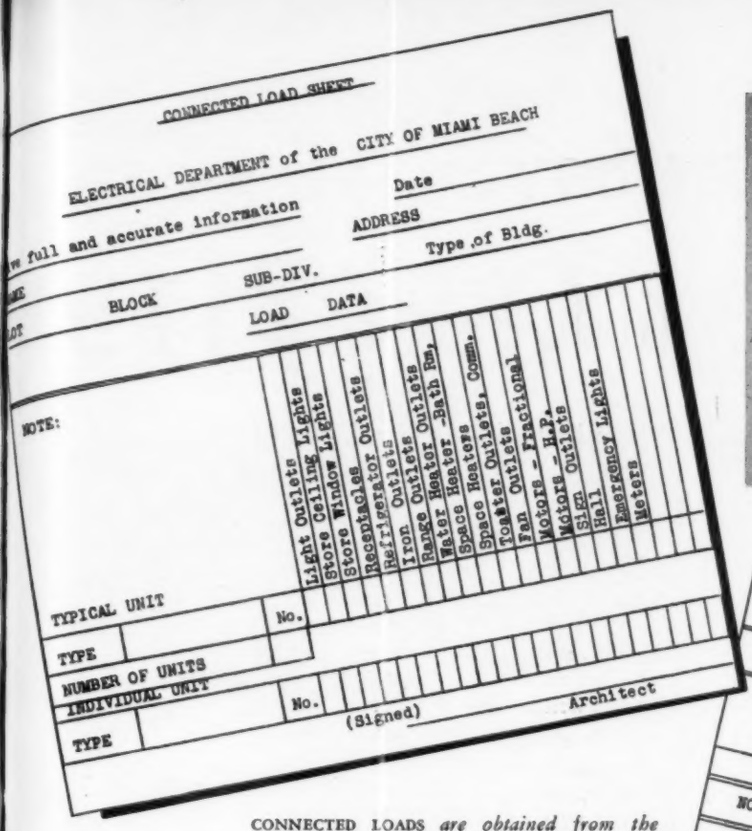
The experience in Miami Beach shows that the foregoing points have the greatest effect upon the electrical system's safety and adequacy. For once the heart of the system is planned correctly and specified clearly, the remaining details are well provided for in the local Code. The chief difficulty is to provide adequate service and metering capacity of proper design and with sufficient space to make a safe and workmanlike installation.

This procedure was begun about a year ago. It has gradually been so improved and systematized that the daily demands upon the inspection department do not overtax its staff. Miami Beach construction totalled 12 million dollars during the year ending October 31, 1937. It amounted to 6¾ millions this last year. Two inspectors, H. C. Inman and Lincoln Brown, Jr., handled all the electrical design details and inspections for some 45 licensed electrical contractors who did this work.

To standardize its layout procedure the city has developed a 41-page bulletin devoted entirely to the design details of metering layouts. This bulletin contains designs and specifications which fit 50 per cent of the jobs. It is also a reference guide which contractors, architects and engineers may follow on their own. It shows various metering layouts of the horizontal, vertical and combination makeup, including many for outdoor installations. These standard layouts provide the basis for creating the special designs required for about half of the jobs.

The inspection department's layout procedure embraces these features—

1. Architect's outlet schedule is extended and load values are calculated therefrom.
2. Power company service location sketch is coordinated with space conditions surrounding the job plans.
3. For layouts which employ standard numbered designs appearing in the metering layout bulletin, this standard type is designated. A mimeographed page showing these details goes to the architect.
4. Special layouts are worked out in the inspection department, a pen-



CONNECTED LOAD SHEET

ELECTRICAL DEPARTMENT of the CITY OF MIAMI BEACH

Date

w full and accurate information

ADDRESS

Type of Bldg.

BLOCK SUB-DIV.

LOAD DATA

NOTE:

Light Outlets
Light Ceiling Lights
Store Window Lights
Store Wiring Outlets
Receptacles
Refrigerator Outlets
Iron Outlets
Range Outlets
Water Heater -Bath Rm.
Space Heaters
Space Heaters, Comm.
Toaster Outlets
Fan Outlets - Fractional
Motors - H.P.
Motors Outlets
Sign
Hall
Emergency Lights
Meters

TYPICAL UNIT No.

TYPE

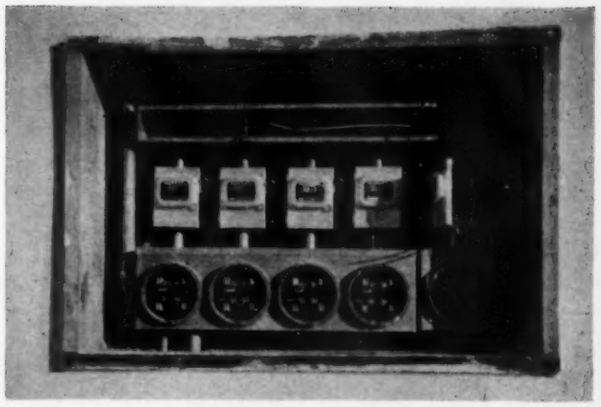
NUMBER OF UNITS

INDIVIDUAL UNIT No.

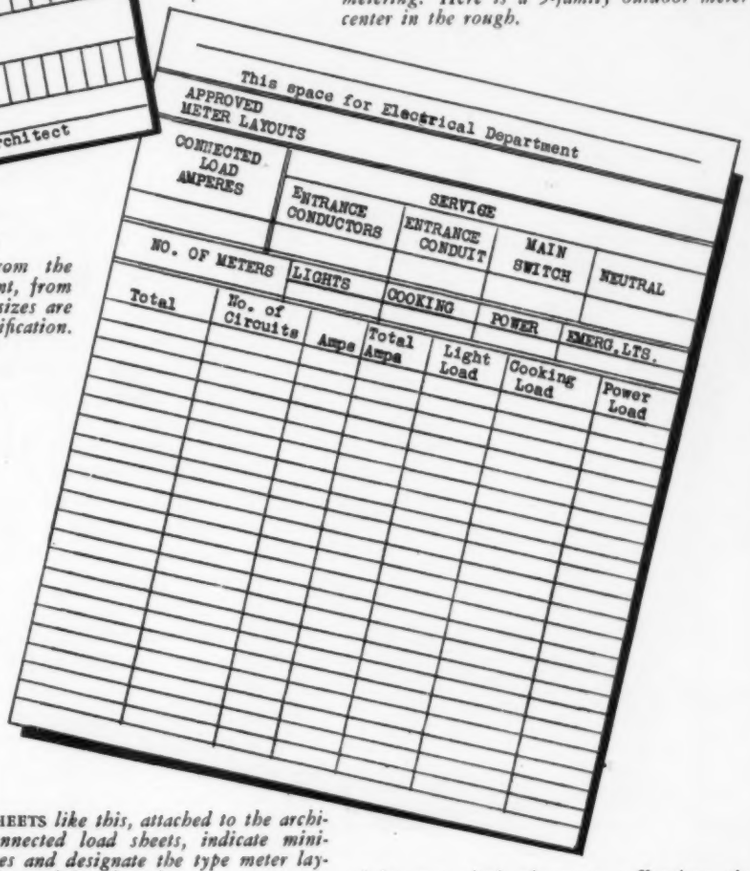
TYPE

(Signed) Architect

CONNECTED LOADS *are obtained from the architect by the inspection department, from which all service, switch and feeder sizes are calculated for the final plan and specification.*



UNIFORM CONSTRUCTION *details have been developed for the vital points of service and metering. Here is a 3-family outdoor meter center in the rough.*



This space for Electrical Department

APPROVED METER LAYOUTS

CONNECTED LOAD AMPERES

SERVICE

ENTRANCE CONDUCTORS | ENTRANCE CONDUIT | MAIN SWITCH | NEUTRAL

NO. OF METERS | LIGHTS | COOKING | POWER | EMERG. LTS.

Total	No. of Circuits	Amps	Total Amps	Light Load	Cooking Load	Power Load

WORK SHEETS *like this, attached to the architect's connected load sheets, indicate minimum sizes and designate the type meter layouts to be used for the job.*

cil sketch is submitted to the architect. Carbon copies are retained for the contractor and the department files.

In no case is a layout determined until the essential factors of adequate service conductor size, service switch and meter switch size have first been calculated. These values are determined for both standard and special layouts.

Some of the special details that are covered in the meter layout bulletin show how grounds must be interconnected, methods of recessing metering and switching centers, and how meter gutter connections must be made. It all sets up standards for good workmanship based on uniformity in design. This tends to keep costs to reasonable limits for adequate electrical systems.

Back of this procedure is a system for doing this work quickly. For architects usually receive the inspector's layouts within 24 hours after their certified outlet schedule comes in. This service applies to new residences, apartment buildings, stores, theatres and hotels.

The inspection department's free designing service does not compete with the consulting engineer, however, because no attempt is made to develop the electrical layout beyond the scope described. Also any architect's own layout is welcome provided it meets approval. The matter of outlets per circuit, wattages per outlet, motor circuits, wire sizes for ranges, electric heaters, signs and other special outlets are clearly covered in tables provided in the local ordinance. Once these values are taken into consideration on the architect's original schedule of connected loads, there is no "out" for those who would chisel the owner.

The public interest is the first consideration, but the city's building inspection staff realizes the need of cooperation with architects, engineers and contractors before wiring bids are requested. The object is to steer them right on vital elements affecting the factors of safety and adequacy of electrical installations. As a result, jobs are now begun on a clean cut basis and the owner is not involved in delays. Furthermore, every bidder knows beforehand just what must be provided.

To simplify the problems encountered in routine inspections, the department gets to work with the architects in the early stages of every job. They make him the basis for their authority to regulate the standards of good electrical design. And it has worked out so well that the local electrical contractors also praise the plan. For the inspector leaves few loopholes for chisellers.

BAKER SELLS 'EM *for the Rocky Mountain Electrical League.*

Baker Saves the Bacon . . . and PROFITS

A page from the daily doings of a hard-hitting League field worker which proves that wiring can be sold.

LIKE a lone missionary, eight years ago John A. Baker, Denver field representative of the Rocky Mountain Electrical League, began to spread the gospel of adequate wiring, convenience outlets and proper lighting among architects, contractors, builders and home owners. Today John's converts can be numbered in the hundreds. Thousands of persons now enjoying the full benefits of electric service have reason to thank him.

John's daily reports—hundreds of them—in his bluff style, picture what he is doing day by day to build the market for wiring, fixtures, lamps, ranges, fans, radio outlets, refrigerators, water heaters.

Here is proof that the public responds to such sales effort. These typical reports tell their own story, as he writes—

"A Hell of a Job": This started out to be a hell of a job. Outlets in ceiling of bedrooms off center. Other haywire arrangements. Recommended changes. Put 4 bracket lights under shelving in kitchen, 1 range light, 3-way switch; center outlet in dressing room, one 1250 watt heater in each of 2 bathrooms. Replaced Skelgas water heater in basement. Put 5 lights on eaves. All our recommendations on this house adopted, and more too. Increased wiring capacity 10,900 watts.

Revamps Wiring Ideas: This guy certainly is strong on how little, instead of how much, wiring and equipment a home needs. However, we talked him out of some of his funny notions. Added 2 bath outlets, 1 ceiling and 1 switch; rear hall, 1 ceiling and 1 convenience outlet; kitchen, 1 ceiling; 1 convenience outlet in each of 3 bedrooms. Increased connected wiring capacity 1,920 watts.

A "Big Time" Job: Worked all day with Mr. ..... and only began. Will get in burglar alarm, cove lighting throughout, master control for lighting inside and out, and the maximum in wiring. Heaters in bathrooms. Red Seal Award. Increased connected wiring capacity 6,500 watts.

The Reward of Hard Work: Constant razzing of ..... is certainly getting results. He doesn't skimp like he used to. Getting so he listens to my recommendations. Added 27 outlets, bathroom heaters, telephone, and outdoor lighting. Increased connected wiring capacity 2,100 watts.

Hotel Goes Electric: By request of architect ..... we checked plans for this hotel. Not much to start with. Succeeded in including in each room 1 radio outlet, additional bathroom light and 1 convenience outlet. Added 12 convenience outlets in lobby, 8 in tap room; also 8 floor light outlets. Stepped up lobby lighting. Increased connected wiring capacity 28,000 watts.

Everything But Wiring: By request of Mr. ..... inspected his wiring. Eight rooms on two circuits. Fuses blowing every day. Had motors on same circuit. Put in 6 circuits, separate lighting and motors. Rewired convenience outlets, which were exposed.

Hates Changes: Mr. ..... (architect) sure hates to make any changes in his plans, but we sold him on the following—additional: 1 convenience outlet, 1 3-way switch in living room; 1 ceiling, 1 3-way switch in kitchen; two 1250 watt heaters in bathrooms; 1 convenience outlet each of 4 bedrooms. Increased connected wiring capacity 3,200 watts.

Real School Lighting: Lighting layout in these two rural schools, ten 200 watt lamps. Our layout included fifteen 750 watt indirect lights in two main rooms and four 200 watt lamps in dressing rooms. Increased connected wiring capacity 8,600 watts.

Another Poor Job Improved: Checked this layout for .....Found switching poor, no center outlets, inadequate wiring. ..... likes to cut corners on his electrical work, but we added 7 convenience outlets, 3 switches, 6 ceiling outlets and 4 brackets. Increased connected wiring capacity 1,800 watts.

A Good Build Up: Mr. ..... is another we have built up to doing a good job of electrical work. Took a long time. This was a small home but we added 2 convenience outlets, 3 switches, 2 ceiling outlets and 1 bracket. Increased wiring capacity 660 watts.

These are just a few examples of what can be and is being done in the field. It proves that wiring is salable. It indicates how much our wiring standards would be improved if every community had John Bakers at work saving the industry's bacon.

"The Finest Switch on the Market—and again Improved"
1. Modern styling
2. 1 screw cover fastening
3. Easily removable interior
4. 4, 6 or 8 plug fuse circuits
5. Solderless lugs
6. Shallow depth of case
7. Flush or Surface mounting
8. Non-interchangeable pull-outs
9. Convenient knockouts
10. Series or multiple connections
11. Easy-tite wire holes
12. Reversible mounting (either end up)
13. Solidly grounded neutral
14. Cases—aluminum finish
15. Flush Plates—grey enamel finish
16. Bakelite interior.
CUTLER-HAMMER
ADEQUATE WIRING SERVES AND SAVES
CUTLER-HAMMER
SERVICE CONTROL
C-H
Thousands upon thousands of sales have proved the C-H Bulletin 4334-H15 Range Switch one of the most popular developments any switch manufacturer has ever offered. Now . . . at its peak of success it is *again* improved! 4, 6 and 8 plug fuse circuits, handsome in appearance, better construction throughout . . . to further extend the cost-cutting installation advantages and scope of service of this most successful item. Carried in stock by all Cutler-Hammer wholesalers. CUTLER-HAMMER, Inc., *Pioneer Electrical Manufacturers*, 1306 St. Paul Ave., Milwaukee, Wis.

There's a profit in every foot

ORANGEBURG NOCRETE *the new Dual Economy* CONDUIT

new!

For use underground without concrete encasement

NOCRETE conduit assures you of:

- ***Savings in material costs***
  Orangeburg NOCRETE conduit is about half the cost of metal pipe and less than non-metallic conduits of any comparable quality. Ask our representative for prices. Extra couplings and all types of fittings, ells, bends, etc., are available.
- ***Savings in installation costs***
  It "handles easy"; light in weight, in handy 5 or 8 foot lengths (in various sizes), this super-sturdy duct will surprise you by its adaptability. It assembles and installs easier, faster and at a lower cost than any conduit you have ever used. It is readily cut and fitted with ordinary wood-working tools.

Carrying heavy pipe is a back-breaking task on any job. It's doubly true on outdoor jobs, where carrying distances may be long indeed. Naturally, such jobs eat up money —PROFITS—

unless you use NOCRETE *conduit*

NOCRETE is relatively light; a man, or a truck, can carry two or three times as much "footage" as is possible with standard iron conduit. Freight costs are lower and are reflected in the substantial savings on "material costs" your cost sheets will show. Why not use it on your next underground job and profit from this modern conduit. Wherever it's "underground," there's more profit in Orangeburg on even the smallest job.

Write today for complete information.

Ask for Bulletin ECDM.

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ORANGEBURG

POWER APPARATUS

Your Market for Power Apparatus

A close-up of the opportunity and how to turn it to good profits.

A STEADY paying market for motors and control exists in every city. Every electrical contractor and motor shop man knows that. But many industrial contractors and many motor shops are now getting very little out of this market.

Probably the main reason is that these men feel that motors today are bought and not sold. And this is true. They feel that it requires too much effort, too much specialization to make money on power apparatus. But those who have been successful in this field say—No! This conclusion is not true. And there's a reason.

Here are the benefits that come to the contractor who is equipped and eager to sell motors, drives and control:

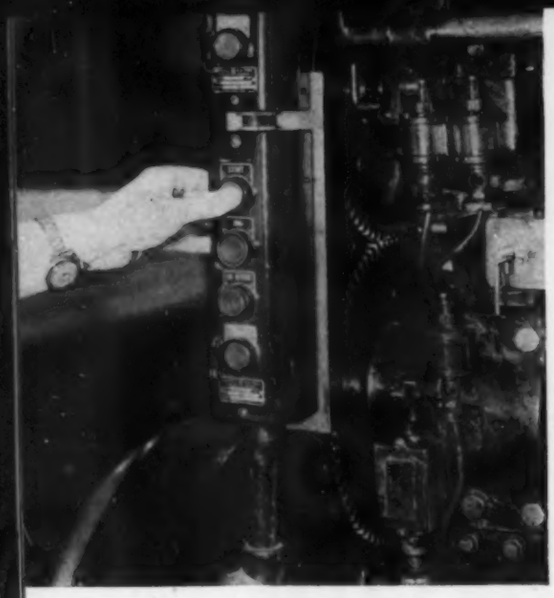
Additional Profit. Even though sales may occur infrequently, this added annual volume can be made worthwhile.

More Contact with Industries. Inquiries regarding power apparatus widen your acquaintance with your industrial community more than selling installation work only.

A Close-up of Plant Operations. Working out power applications usually involves discussions and investigations of various processes and methods with the plant staff. This uncovers unseen opportunities for future business in wiring.

Increased Prestige. The ability to take care of power application and control sets you up with more prestige among your prospects. It encourages them to call you in on lighting, venti-

PERFORMANCE RECORDS *are being made on many tough jobs assigned to modern motors. This one is exposed to cement dust in driving a conveyor bucket in a cement mill.*



CONTROL ACCESSORIES *offer many combinations of fingertip operation for complex machinery. Find places to save steps for machine attendants by additional button stations.*

lation, drives, noise abatement and other profitable business.

These benefits are worth going after. They are worth what it takes to build up a reputation for knowledge and skill in this field. And there is plenty of business to be had from people you now know and others you will reach, once they begin to turn to you to help them with their power problems also.

Why Factories Buy

Since power apparatus is only bought when it is needed, your best approach to the waiting market in your town, of course, is an analysis of why factories buy motors, drives and control. In a word, finding sales opportunities in this field is first a matter of locating, in local factories, places where a better use of power will improve products, raise efficiency, decrease spoilage, lower overhead or give better working conditions. The second step is to show these possibilities to the management. The discovery of these opportunities comes best from a check up of the various bad conditions common in neglected or mis-applied power apparatus that too often wastes money in modern manufacturing. For example:

1. *Motors Displaced*—Motors are shifted here and there to keep production going, and soon result in wasteful underloading, overloading and mis-application of machines in daily operation.

2. *Processes Changed*—Apparatus is continued in use though unsuited to new conditions of moisture, fumes, dust, explosive gases or harmful chemicals.

3. *Layouts Altered*—Additional machines or rearrangement make space-saving drives or sectionalized power transmission advantageous.

4. *Operating Handicaps*—Controls depend too much upon human supervision. Steps are wasted. Protective functions are not dependable.

5. *Excessive Costs*—Inefficient motoring, bad power factor and high maintenance expense create high operating costs.

Find the Symptoms

To run down these conditions, there are definite symptoms to look for, readily found in any plant where they exist. And automatically they uncover causes and suggest measures:

1. *Bad Power Factor*—Penalties charged by power company, or extra burden imposed on the feeder system, or reduced load carried by motors.

2. *Poor Voltage Regulation*—May sometimes be improved by replacing present motors with types having lower starting peaks, low inrush or less variation in speed.

3. *Excessive Burnouts*—Where motors are subjected to dirt and gritty flyings, as in cement plants, foundries, grain handling and grinding, totally enclosed fan cooled machines should be substituted.

4. *Noise and Vibration*—Due to incorrect motor type, drive or mounting accessories in factories, hotels, apartments, hospitals and theaters.

5. *High Maintenance Costs*—Resulting from inadequate controls and improperly applied motors and drives.

6. *Underloaded Motors*—In use where smaller motors will give better efficiency, or a more modern design offers better characteristics for the application.

7. *Overloaded Motors*—That tend to run hot and limit production because it is necessary to take lighter cuts or use lower speeds.

8. *Moisture Damage*—Due to frequent washing down. Here splashproof motors should be substituted as in dairies, packing plants, breweries, creameries.

9. *Explosive Conditions*—Where motors and controls are operated in areas laden with fumes or vapors of an explosive nature, replace with approved types, as in cleaning and dyeing, paint shops, drug, chemical, paint and varnish plants, and where gasoline is handled.

10. *Hazards to Employees*—Where dangerous machines need convenient control stations, emergency control devices, limiting switches, pressure controls, guarded drives and other safety measures.

11. *Waste of Space*—Where geared or short-center drives can reduce congestion.

12. *High Supervision Costs*—Where machine tending can be reduced by travel limits, speed control, alarm devices, reversing cycles, sequence starting and tripping devices.

13. *Lack of Coordination*—As in processing foods, where motors, controls and instruments must be in step, such as in weighing, mixing and conveying in the bakery, and similar processes in coffee roasting, distilling and handling meat and provisions.

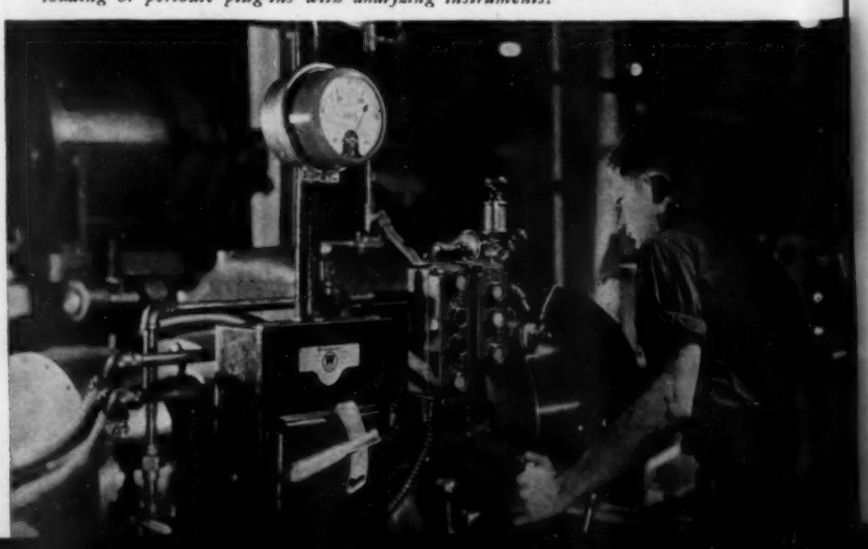
14. *Interference with Light*—Due to a clutter of overhead belting and pulleys that can be relieved by a rearrangement of power transmission.

15. *Product Spoilage*—That can be prevented by instruments and control devices, as in textiles, chemical plants, printing and engraving, paper manufacturing, food processing, flour milling and other integrated operations.

This is the age of industrial competition, and the emphasis is on costs. Therefore, production schedules are scrutinized closely. The cost of every operation is studied. Power costs are analyzed in relation to output. Payrolls are broken down into departments. Individual time studies are made to determine normal unit costs. All this throws the limelight on power performance. It opens the door to the man who can point out where improvements can be made by substituting more appropriate motors, drives and controls.

But to be helpful with these problems of factory management, the elec-

NERVE CENTERS *of intricate machine tools need more than good control facilities. This operator's instrument socket provides for permanent indication of motor loading or periodic plug-ins with analyzing instruments.*



FUNCTIONS CENTRALIZED *with magnetic control, as in this layout for fruit packing plant conveyors, give latitude for improvements in control application. It adds prestige to modernization.*

CHECK CHART OF MOTOR AND CONTROL TROUBLE

Symptoms and their probable causes which indicate need for new equipment

One or more of these CAUSES → are indicated by the following SYMPTOMS ↓	Worn bearings	Improper drive	Slush bust	Low voltage	Low power factor	Too large for load	Too small for load	Improper enclosure	Wrong electrical characteristics	Protective relays too large	Protective relays too small	Improper speed control	Poor ventilation	Defective windings	Inadequate feeders	Improper location	Defective wiring	Inadequate safety control	Inadequate maintenance
MOTORS																			
Frame — hot	X			X	X		X	X		X			X	X					X
Bearings — hot	X	X	X																X
Excessive vibration	X	X	X																
Excessive noise	X	X	X						X										
Winding failures							X	X	X	X			X	X					
Speed — slow				X	X		X		X			X					X		
Loss of power				X	X									X			X		
Relays trip							X		X		X			X					
Fuses blow							X			X				X	X		X		
Power factor low						X			X										
MOTOR OR CONTROL																			
Operating parts exposed — to moisture or dirt								X								X			
— to explosive gases								X											
— to mechanical injury								X								X			
Speed reduction — insufficient						X			X			X					X		
— excessive				X	X		X		X			X					X		
CONTROLS																			
Excessive wear								X		X									X
Excessive heat					X			X	X	X			X	X	X		X		
Pitted contacts					X			X		X							X		X
Welded contacts								X		X									
Excessive arcing					X			X		X									
Sluggish operation				X						X							X	X	X
Resistor burnouts								X	X	X			X	X			X		
Excessive dirt									X								X		X
Accidental operation									X								X	X	
Mechanical failure									X								X		X

trical man must talk the language of the plant. For their real problem is production, operation and profits for that factory. Motors, drives, control and instruments only meet the needs.

Problems of Industries

And in each industry, of course, the problems, and the needs are similar, because the processes and the products are the same. The basic concerns of these industries that offer the most promising field for power apparatus sales are shown in the chart. And the very similarity of the conditions found within an industry encourage the contractor to specialize in correcting faults one group at a time:

1. *Food Processing*—Here increased emphasis on cleanliness requires hosing down and steaming of machines. So splashproof motors should be used to reduce insulation failures from moisture saturation. Controls likewise require isolation from water damage, or suitable enclosure. Additional controls save steps.

2. *Metal Trades*—Individually motored machines are the trend, with built-in motors and controls a feature of most new machine tools. Existing equipment in many machine shops, stamping and fabricating plants can often be improved by applying individual motors and step-saving control features. Here important advantages often are possible, without the replacement of expensive shop machinery.

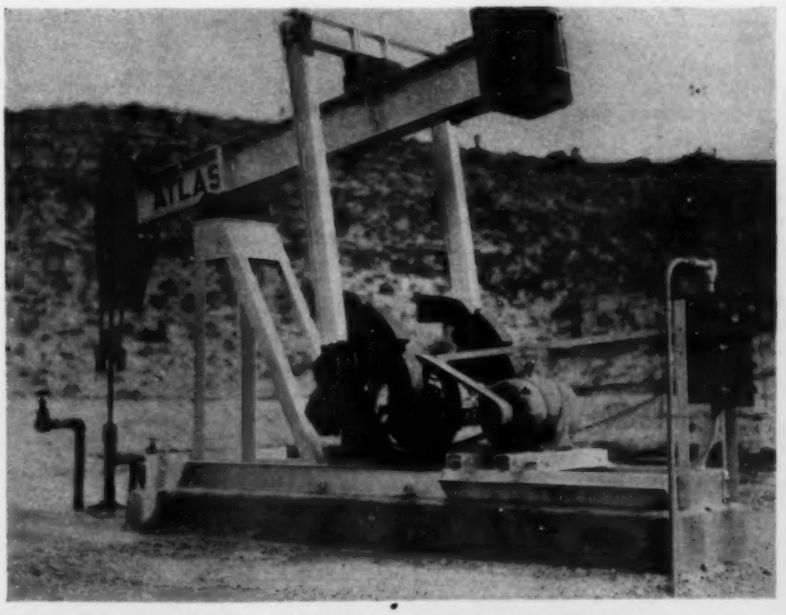
3. *Woodworking*—Tough loads are commonly encountered around planers, sanders, mortisers and other machines in the planing mill. Maintenance often runs high and stoppage of work is frequent on old belted drives. Here the chief objectives are suitably enclosed motors of correct rating, efficient drives and controls which assure maximum safety to the workers. Sometimes replacement of standard frequency motors with high frequency motors and a motor generator set to supply high cycle current is justified.

4. *Foundries*—Motor rewinding and bearing replacement costs, and general repairs to starters and other apparatus become important items of the foundry's operating cost where improper types of equipment are used. Totally enclosed motors and controls, proper application of sizes to handle heavy loads, maintenance-free drives and other refinements to smooth production are your cue here.

5. *Chemical and Dye Works*—Expensive repairs and shutdowns may be avoided by guarding against corrosion and deterioration of insulated windings. Modern equipment is made to fit these tough working conditions.

6. *Stone and Gravel Plants*—These plants are often started with second-hand equipment that is rarely of suitable design for the abusive loads and dirty conditions that prevail. As the business grows, the economy of substituting better facilities in keeping with increased production demands can be demonstrated.

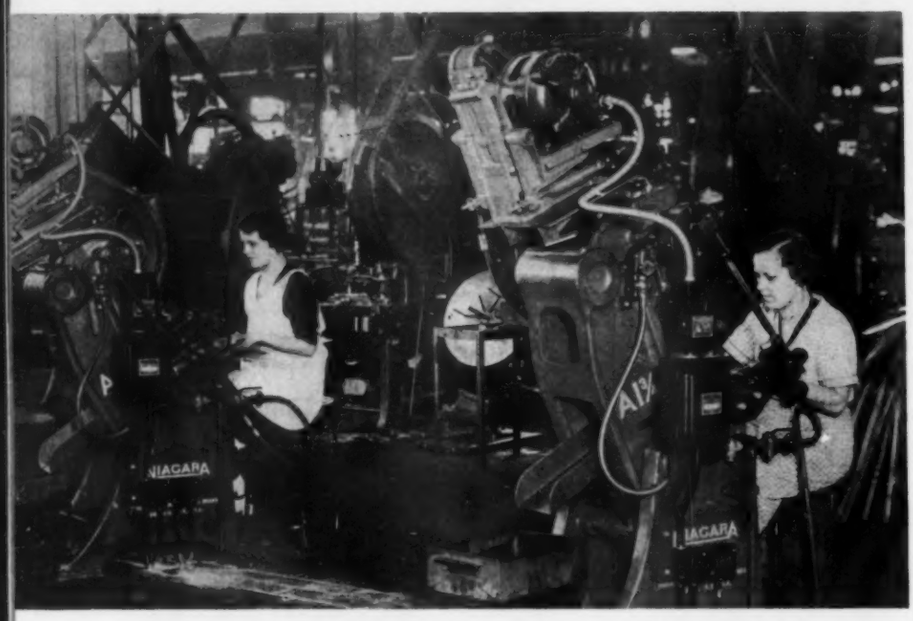
7. *Textile Industry*—Good light and safety are important influences for replacing antiquated power facilities in mills of various kinds. Here the application of smaller, closely rated, and uniform units of motor, drive and control call for extensive changes for the electrical system.



OUTDOOR APPLICATIONS *often employ improperly selected power apparatus, resulting in breakdowns and frequent repairs. The added cost of enduring equipment used for this Texas oil well pump represents a wise investment.*

Finding Ripe Power Prospects

How to proceed in preparing for a motor and control program.



SAFETY MEASURES *for industrial workers have a powerful appeal. Step saving control and localized power, as at these punch presses, suggests improvements to be made for many other similar industries.*

MERE listing of a group of the best prospects does not get you anywhere. The point is to pick out those ready to buy now. And this can be done too. For obviously certain lines of business that are prospering this year are better bets than others now suffering hard times—and there are other reasons.

So the next step is to check your list of natural prospects and ask yourself these questions—

1. *Are any local plants expanding their production?* Check up here and there on which companies are moving ahead right now. Various suppliers can tell you.

2. *Which plants or departments are being moved?* Knowing how to cooperate in the early stages of such undertakings will win new customers from these listed prospects.

3. *Where are power changeovers contemplated?* A change from d.c. to a.c., the removal of engine driven transmission, or the abandonment of generator equipment in an isolated plant, offer definite prospects for improvement in apparatus.

4. *Who is making production improvements?* Plant re-tooling or changes in production methods often leave power problems not anticipated. Learn where and when such changes are being made. It is a most effective method of locating good, ripe prospects.

5. *Where have recent fires, explosions or flood damages left need for replacements?* Here are prospects needing quick action if they are to be turned into customers.

6. *What new companies are starting in business?* Make prompt contact, for assistance rendered in power matters may lead to the purchase of apparatus.

To run down such prospects can be made a relatively simple procedure in any community. Look first for the kinds of plants with which you are most familiar. Don't tackle a strange industry until you are ready to discuss their problems in their own terms and to make the right recommendations. First know their principal production problems and what is most likely to go wrong. It may sound hard. It is easy—if you go about it systematically. Here are the steps to follow.

1. *Organize a prospect list*—Set down what look like the best factory prospects in your area—what they do—their approximate size—the key men to see about power and production problems. Look for smoke stacks, for deisels and gas engines and all the other indications.

2. *Consult your power company*—Cultivate the friendship of salesmen and engineers on the power sales staff. They are familiar with current problems in the local plants, and know of plans for changes or expansion.

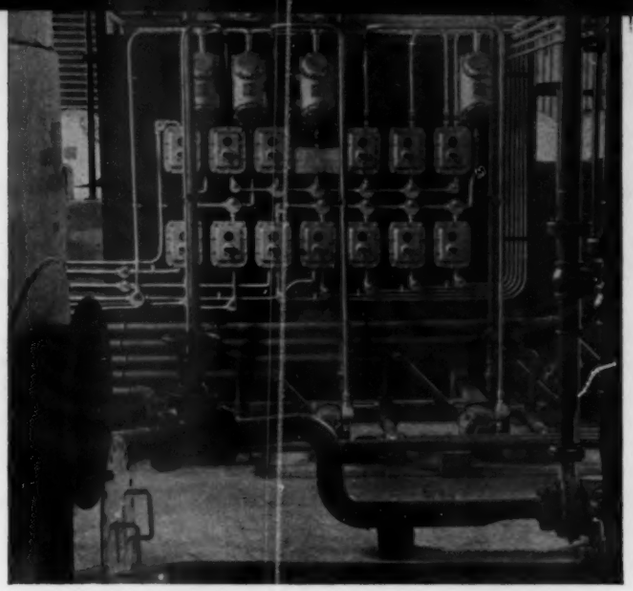
3. *Check up with machinery and equipment agents*—Deals made for new machines or their modernization frequently open up opportunities for motor and control improvements. Your cooperation in the early stages assures first consideration when power apparatus is bought.

4. *Classify plant operations*—Group your prospects according to the service you may render. For instance:

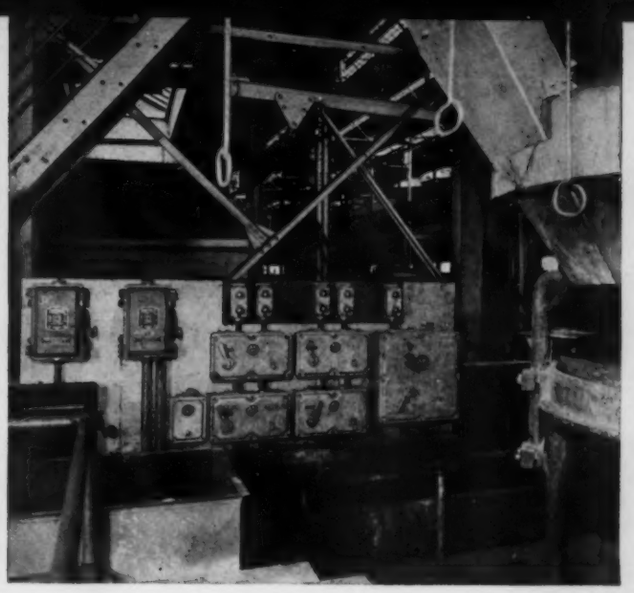
a. Local industries that usually depend upon community service for their needs.
b. Branch plants that buy through a central purchasing office, or buy locally from lists of material approved by a central office.
c. Staffed plants that have an engineering and maintenance organization in charge of mechanical matters.

Then out of this list select those factories where you know there is activity of some sort or some problem that makes a favorable situation for you *right now.* And with this done, you are ready to start making contacts. How you will arrange these opening calls will depend on circumstances. Sometimes you will walk in cold turkey, knowing the need. Sometimes you will approach through the introduction of a friend, another customer. You will know what to do in each case.

Meanwhile, the rest of the list should neither be neglected nor forgotten, for here is a rich mine of potential profit. And since it waits upon the day when other factory managers will turn to you for help on power problems, it will be smart to advertise. Send letters, pictures of recently completed jobs in other local factories, before and after views, testimonials from other customers. A little money expended in this way will pay good dividends.



EXPLOSION PREVENTION *in this southern alcohol plant called for approved enclosures for centralized across-the-line motor starters. Plants which change to hazardous processes need your help with their control problems.*



ADEQUATE PROTECTION *against dirt and corrosion, for these foundry motor starters, reflects good application sense. Some trouble sources among your plants will need these lasting enclosures for hard-worked controls.*

What to Know in Selling Power

How to organize your knowledge, data and cost experience so that it will help you sell.

SINCE power apparatus is bought today from the man who proves himself helpful in motor selection and application, what preparation is needed? Factory customers turn to you only if they know you have the knowledge, the data and the installation experience they need to guide them. And this data and experience must be ready for use.

Boiled down, to make money through the sale of power apparatus, the industrial contractor must be ready with three things. He must have knowledge of the equipment to be applied and full data on it in a form convenient for reference and for showing to the prospect. He must have a well organized procedure for analyzing conditions, in any factory, and running down all possible opportunities for improvements in power apparatus practice. He must have a "case book" of experience that shows how power improvements in different kinds of factories have brought benefits to the customer. These cases will include as many as possible of his own installations, with before and after photographs and testimonial letters.

Data on Equipment

Fundamentals of application are covered by the price books and catalogs of manufacturers, and by many available text books and electrical publications. From these sources and your own knowledge build up your data book. It should include—

1. *Motors*—Standard, special wound, integral-geared, splash-proof, explosion-proof, totally enclosed.

2. *Power Transmission*—Adjustable bases, pulleys and belting, chain and gear drives, speed changers, noise insulation, magnetic brakes, clutches.

3. *Control*—Remote and automatic, reversing, interlocking, sequence operation, protective refinements.

4. *Auxiliary Controls* — Additional button stations, unit switches, pressure, temperature and timing controls, electronic applications, electrically operated valves.

5. *Instruments*—Portable testing and analyzer sets, fixed indicating and recording instruments. Sockets for installing portable instruments at individual machines. Program or duty cycle timing instruments.

6. *Corrective Devices*—Capacitors for power factor improvement, voltage regulators.

7. *Special Power Facilities*—Local transformers, motor-generators, converters, rectifiers, frequency changers, batteries.

Organized Procedure

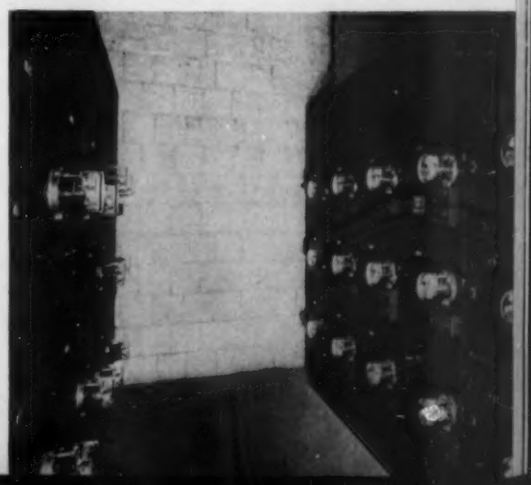
When you approach an industrial prospect on a matter of power apparatus, there is only one place where the answers can be found. That's in the plant. And those answers come only if you ask yourself the right questions. There are four sets of questions to be run down on such a power checkup—

1. *Questions on the electrical system*—

a. What are the circuit characteristics? —Whether a.c. or d.c., voltage, number of phases, and what frequency or cycles.

b. What is the application?—If a motor, get the details of drive, whether by belt, V-belt, gear, coupling, correct speed ratios.

DEPARTMENTAL METERING *aids in checking production costs. Here each of 26 main feeders to sections of a plant have socket-type watthour meters right on the main switchboard.*



c. What is the load?—Whether constant or variable speed, starting easily or hard.

d. What control is needed?—Local or remote stations, details of protection, safety provisions.

2. *Questions on the Motors—*

a. Is more motor power required due to the installation of additional machines or the increased loading of present machines?

b. Have motors become damaged beyond economical repair, or unsuited for use because of changed working conditions?

c. Are individual motors required for each machine for an altered method of drives or for a rearrangement of sizes, to suit group or sectionalized drives?

d. Will replacement of improperly applied motors provide correct speed, regulation, starting, reversing or other required features?

e. Does important equipment lack spare or emergency motors?

f. Are there any conditions of overloading or underloading?

g. Do motors show inability to start tough loads?

h. Are motors unsuited for use under prevailing operating temperatures, excessive moisture, harmful dust or grit, explosive gases or liquids, corrosive chemicals?

i. Do they fail to hold up under frequent starting, reversing or variations in load?

j. Which motors lack proper speed regulation?

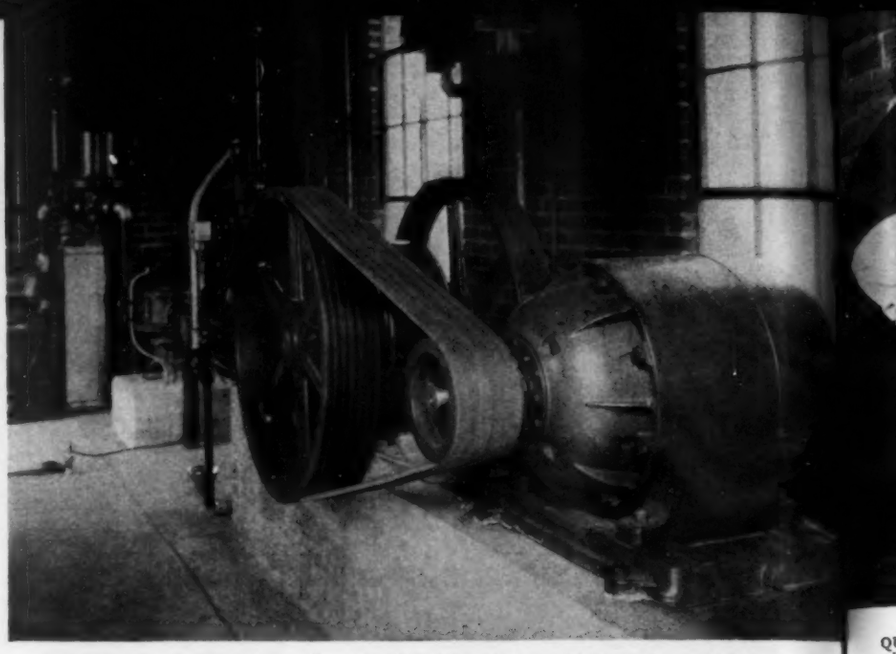
k. Are any motors obsolete because of inherent characteristics of low efficiency and low power factor?

l. Have you looked for "cripple" motors? Have any been improperly rewound or re-connected, coils cut out or altered, for use at other than frequency for which originally designed?

3. *Questions on Drives—*

a. Is it necessary to save working space?

b. Can wasted power and slip be eliminated?



HAZARDOUS PROCESSES *are often developed in plants, which require explosion-proof apparatus to replace former open types. Keep posted on the changes that occur in your industries.*

c. Will maintenance be cut down?

d. Can you provide better speed control?

e. Can factors of safety be increased?

f. Can you reduce noise and vibration?

g. Can lighting conditions be improved by removal of ceiling belts and shafts?

4. *Questions on Control Equipment—*

a. Is present control inadequate as to duty cycles, abusive operations?

b. Is it unsafe for workers to operate?

c. Is it adapted to maximum flexibility?

d. Is it able to properly protect motors?

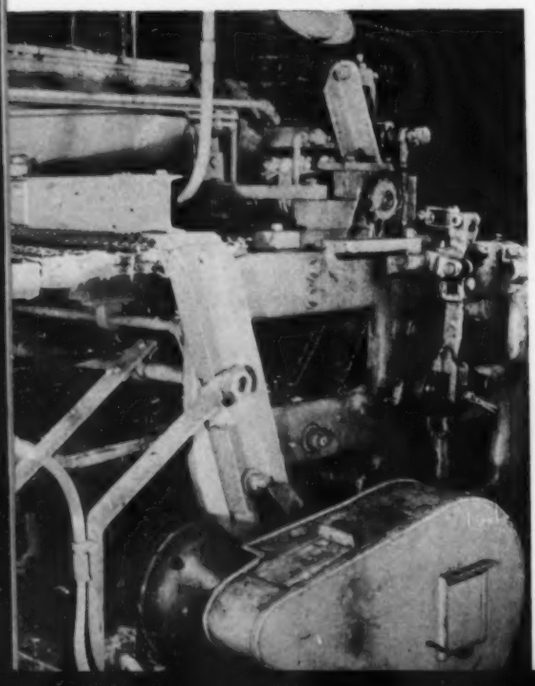
e. Is it unsuited to surrounding temperature, fumes, moisture or hazardous areas?

f. Is it too costly to maintain?

g. Is it adapted to machines on which now used—for example, in pulling heavy surges?

h. Is there need for modern magnetic or automatic control:

1. To give control of motors from one or more stations—to save steps—to avoid breakage and waste?
2. To permit automatic control without dependence upon human element?
3. For operation of motors at a distant point?
4. For greater safety in control of high voltage equipment?
5. For placing control in out-of-the-way places—to effect savings in space, protection from injury or damage from moisture, fumes or other harmful working surroundings?
6. To provide adaptability to auxiliary devices such as pilot and limit switches; float, pressure, vacuum and temperature controls, also electronic devices?
7. To improve plant appearance and ease of cleaning?



TROUBLE FREE *operation is possible with appropriately enclosed motors in places where open motors would break down. Here a splash-proof motor, for a candy mold machine, protects the windings from dripping syrup.*

5. *Question on Instruments—*

Plants need instruments for routine maintenance checkups for the supervision of processes or machine operations. With management becoming more familiar with instrumentation, the places to sell them become more numerous. This applies to fixed and portable instruments, of both indicating and graphic types. Some of the instruments for which applications are most commonly found include—ammeters, voltmeters, wattmeters, frequency meters, power factor meters, analyzers, watthour meters, demand meters, and megohmmeters. Are there places in the plant where instruments can be used:

a. To indicate the degree of loading machines and conveyors?

b. For checking load consumption and power costs?

c. For registering fluctuations in voltage?

d. To regulate fluctuations in peak loads?

e. To check reactive load and inefficient motorization?

f. To test insulation resistance values of motors and wiring system?

g. To indicate machine speeds?

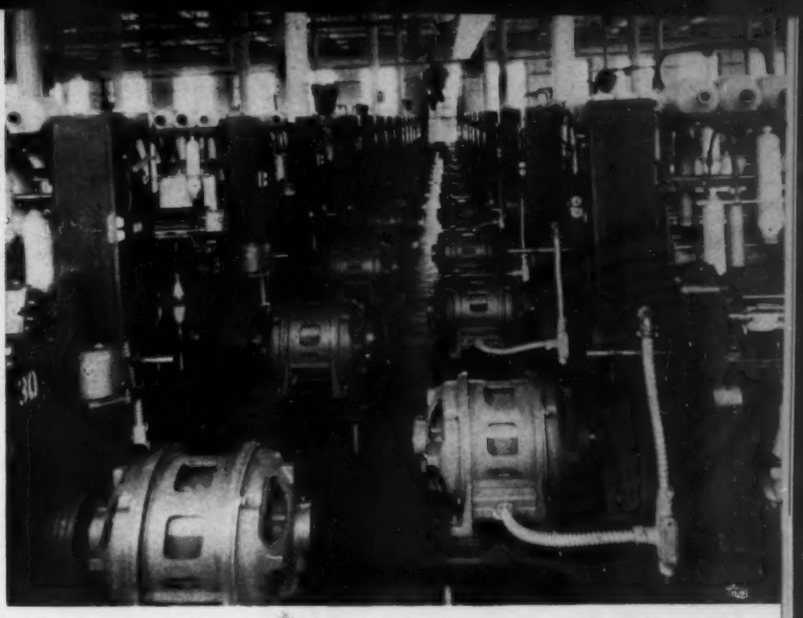
h. To regulate flow of fluids and other processed substances?

i. To check total loads at various periods of the day?

j. To permit limiting peak demands?

Digging beneath the surface of apparent plant efficiency this way will reveal many conditions that need correction. As plants change production or layout, what was once a satisfactory arrangement often becomes unsuited. This may apply to motor performance, methods of driving the load, facilities for controlling operations, or means of recording important load characteristics. In every case you can make an

QUICK READINGS *are usually needed at scattered apparatus to check up loads. To save time and interference with busy machines, split-core testing ammeters are useful.*



SHORT CENTER V-*belts place motor drive maintenance on a new basis, as with these batteries of spindles in a textile mill. Many plants in your town have not yet adopted similar improvements.*

interesting recommendation and out of it will come profitable business.

Your Case Book of EXPERIENCE—

The most effective testimony, of course, comes from the voice of experience. Facts on what some other factory has done in similar conditions is even more impressive than anyone's advice as to what the prospect should do himself. So the "Case Book of Experience" is the best of all selling tools. It is the last word that builds up conviction after conditions have been checked and recommendations have been made.

List in your "Case Book" short paragraphs on cases where other manufacturers have changed their power apparatus and what has come of it. Here are the kind of cases to have ready for quick review—

1. MOTORIZATION

—*Production was Hamstrung* in a New Jersey wire nail plant because its 100 kw. m-g set was too small to supply d.c. for six wire drawing machines at full speed. When all machines were used, they had to be run slower. Installation of another 100 kw. m-g set has relieved overloads, speeded up output and also provide efficient operation at partial loads.

—*Changeover Savings* of $2,500 a year were made by a Brooklyn candy manufacturer on a 500 hp. connected load. Removal of a d.c. generating plant and the re-arrangement of drives for using a larger number of smaller a.c. motors did the trick. Operating costs came down, besides effecting a considerable saving in valuable space with modern drives.

—*Machines vs. Motor Values*—A Connecticut machine tool manufacturer operated eight large planers with frequent shutdowns due to motor or control failures. A complete replacement with new motors and more suitable control facilities involved less cost than the value of one new planer. Now the eight machines are in shape for gruelling production schedules with no time out for repairs.

—*Improving Paint Production*—Removal of a 300 hp. engine drive and belting to several floors meant installing a total of 468 hp. in 30 motors to give greater efficiency in plant production. This change also saved valuable plant space. Now partial operations are possible in this plant without running the old system of engine-driven belting for night shifts or varying production demands.

—*Auxiliary Drive for Steam Plant*—A Chicago food products plant which uses a steam engine to drive its 20-ton ice machine was forced to operate its boiler all summer. By putting in an auxiliary 40 h.p. motor to run the ice machine, the engine and boiler could be taken out of service for the summer at a saving of $4 per day. A flanged coupling in the compressor-engine drive shaft provided a handy means of disconnecting the hookup so that the motor could be belted to the rim of the compressor fly wheel.

QUICK REVIEW OF POWER APPARATUS

The following articles which have appeared in past issues of *Electrical Contracting* are recommended to anyone who wishes to make a quick review of power apparatus, its selection, application and care. These articles have appeared in our Maintenance Section—

MOTORS—
- **February 1938—A.C. motors, types and applications**
- **March 1938—D.C. motors, types and applications**
- **April 1938—A.C. motors, maintenance**
- **May 1938—D.C. motors, maintenance**

CONTROL—
- **June 1938—A.C. motor starters and controllers**
- **July 1938—D.C. motor starters and controllers**
- **August 1938—Maintenance of control equipment**
- **September 1938—Special control problems**

INSTRUMENTS—
- **March 1937—System Surveys for Fact Finding—A special section on instruments.**
- **March 1939 — Instruments — types and applications**

2. DRIVES

—*Doubled Machine Output*—An Ohio manufacturer ridded the whole plant of ceiling belts and shafting and adopted self-contained motor drives for various machine tools. The "flop" of long overhead belts had effected tool cuts, power was lost in friction loads, and maintenance was running high. It was found that after new drives were applied to shapers they removed metal twice as fast when operated at full capacity. With belts gone the machinists could see what they were doing.

—*Underloading Evils*—A chain manufacturing plant's four main line shaft drives were grossly underloaded. Simple transmission changes and re-motoring to proper size corrected poor power factor, allowed motors to operate at nearer full load and effected power savings of $35 per month.

—*Noiseless Speed-Up* of paper mill machines was accomplished with fourteen V-belt drives purchased for $3,500. In this plant the rolls of calenders, the dryer, screens, presses, and fan pumps were all connected to the power shafts through spur gear drives. These drives were belted to the main line shaft.

Attempts to increase the speed of these drives caused chattering and noise in the gear teeth, and vibration was transmitted to bearings. Heavy shocks resulted from applying sudden loads, and stripped gears caused expensive shutdowns and repairs. The change to short-center V-belt drives, eliminated vibration, noise and slippage at a fraction of the cost of other solutions proposed.

3. CONTROLS

—*Jam-up Protection*—When cases jam up in the bottling line conveyor of a dis-

SYSTEM TESTS *of insulation resistance are part of plant survey routine. Reliable megohmmeters are important.*

tillery, it tied up the works for a crew of 54 people. Now an electric eye automatically shuts down the conveyor when an imperfect case reaches the discharge point, where they formerly stuck, and were damaged in the jam-up.

—*No More Buckling*—When buckling occurred in oil-paper passing through a printing press operation, appreciable amounts of paper were destroyed before the press could be stopped. A lever-mounted mercury tube relay is now actuated by the buckling paper, which opens a relay circuit and stops the press.

—*Skip-Stop Switching*—A Chicago beef packing plant uses photo-cell controls to automatically switch alternate carcasses from a travelling conveyor to two inspec tion tables. After passing the "reviewing stand" they again join the common conveyor system.

—*Flame and Fuel Watchman*—An electric eye shuts off a solenoid fuel valve when the flame of an industrial oil furnace is extinguished. The furnace is used to melt metal in a chemical manufacturing process. Its high temperature would have made thermostatic fuel control excessive in cost.

—*Gangway for Truckmen*—When truckers approach the doorways in a Massachusetts fibre sheet plant, photo-cells open motor-operated doors for them and close them again when the worker has rolled his load in the clear. No time is required to open doors between departments, and no one needs to yell "Shut that door".

—*Thread Breaks Stop Motor*—A New Jersey mattress factory experienced high spoilage because its "inner construction" machines were not stopped quickly enough when thread breakages occurred. The solution to this trouble resulted from running the threads through levers under tension. When threads break, the release of lever tension causes a switch to operate a magnetic clutch which stops the machine.

4. INSTRUMENTS

—*Relay Controls Demand*—A small newspaper saved $240 annually by installing a relay which prevents heavy power inrush from boosting the demand rate. When its 25 h.p. press motor is started, this relay cuts out the stereotyping power.

—*Mixing by Ammeter*—In an aniline plant to operate a 20-ton pulverizer most efficiently, the capacity is controlled by checking ammeter readings. An ammeter which indicates the motor load is mounted in front of the operator. It tells when each type of mix is using the machine's full capacity. The controls are manipulated to keep the ammeter reading at the desired position.

—*Departmental Cost Keeping*—An eastern engraving plant provided socket type watt-hour meters for each main feeder serving its various production departments. The cost of energy for lights, motors and electrical heating devices is accounted for in this company's system of checking various phases of production. In addition, a master instrument panel provides separate indications of the plant's voltage, ampere load and power factor.

Grain Handling Simplified—How much grain to load on the buckets of three elevator legs in a large middle western grain elevator is determined by permanent indicating ammeters for each 100 h.p. leg drive motor. These meters are placed before the operator's grain feed levers, where the receiving hopper grain flow may be regulated to full motor load. When too much load causes a motor trip-out, an inter-locked control system shuts down several other drives. The instruments permit steady operations at maximum safe loads in keeping with variations in temperature and humidity.

—*Detect Machinery Wear*—Periodic tests with graphic wattmeters reveal excessive friction in compressors and other high speed production machinery for a metal working plant in the central states. Normal motor loads are fixed at close limits by past maintenance data. When tests show motors pulling excessive loads over a sustained period of normal machine operation, it is evident that repairs are necessary. Getting the facts in time saves breakdowns and more expensive repairs.

These examples, you understand, are brief case comments, to be reviewed quickly by the prospect. They will suggest the scope and possibilities of power apparatus modernization. In themselves, they will not tell the whole story, give the full data. This full background detail you will have available.

POWER FACTOR *correction with synchronous motors widens the motor man's field of application. Here four 75-h.p. units drive beaters in a paper mill.*

CEILING MOUNTINGS *that do not sacrifice drive efficiency are the goal in many plants. This compact drive was possible by the use of a self-adjusting tension base. Show others these benefits.*

Looking for the Symptoms

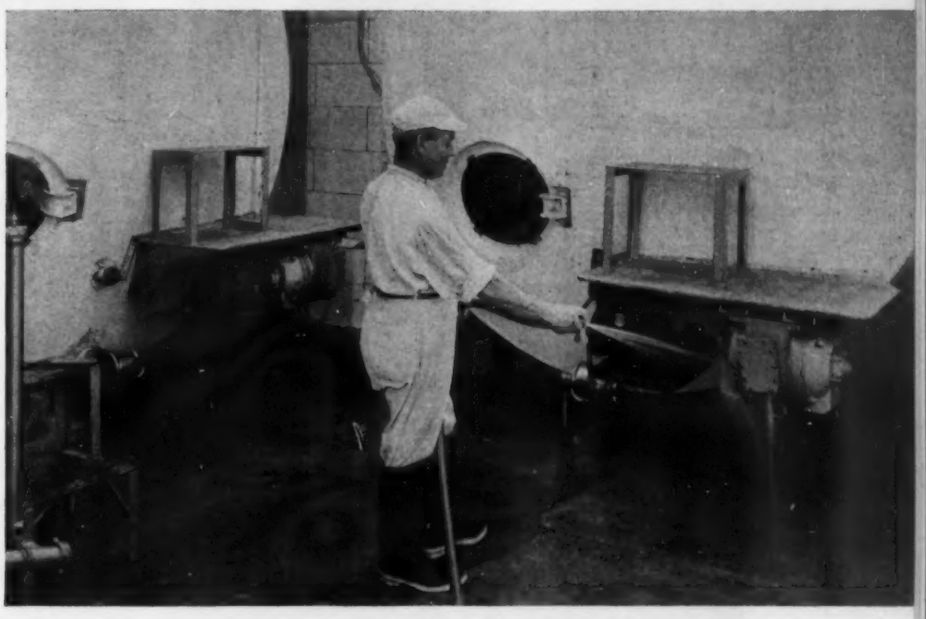
Skill in taking the pulse of motor and control conditions will make or break the sale.

WHEN the doctor sits down and feels your pulse and puts his thermometer under your tongue, watch out! The first thing you know he will have your case sized up and there will be some nasty medicine to take. But he's licked until he checks the symptoms.

It is the same in selling power apparatus. Most of the business waiting in your local factories, is unsold right now, because nobody has systematically looked for symptoms. And when somebody does, then the medicine is going to be taken. And it won't be bitter. It will taste good.

So once the prospect is interested, and you have permission to look the plant over, you need your stethoscope and your blood pressure gadget. Maybe you will just be asked to look over one certain ache or pain, but the good doctor checks everything from head to foot. And you should too.

In a word, make a plant survey wherever there is a possibility of uncovering some places to save money. That means, go in with a variety of instruments—watt meter, voltmeter, ammeter, power analyzer, power factor meter, megohmmeter, tachometer, thermometer—whatever you may need. Then use your four senses—sight, hearing, feeling, smell—and see what you can find. And look for—



MOISTURE PROTECTION *takes prominence in plants where hosing down is a sanitation "must". Look for places where old open motors make maintenance headaches due to such wet surroundings.*

1. *Hot motor frames*—May be from rotors that rub the stator, low line voltage, bad power factor conditions, over-loads, improper enclosures, poor ventilation, or defective windings. Test with an accurate thermometer. Unless the trouble can be cured by minor repairs, sell a new motor.

2. *Hot bearings*—May be due to wear, tight drives, bent shafts, electrical defects in the rotor, or lack of oil. Sell a new drive or new ball bearing motors.

3. *Excessive vibration*—May require new bearings, a new drive or vibration absorbing bases. When bent shafts cause vibration, the cost of repairs may justify a new motor.

4. *Excessive noise*—May be worn bearings, improper motor or drive, or a bent shaft. Sell a repair job to quiet the drive, a sound absorbing base or a new "quiet operating" motor.

5. *Winding failures*—Check for overloads, incorrect electrical characteristics, improper enclosures, incorrect protective relay equipment or poor ventilation. Sell the necessary corrective equipment.

6. *Slow speed*—May indicate over-load or low line voltage, poor power factor, improper speed control or defective wiring. Sell a larger motor, power factor correcting equipment, higher ratio drive, new speed controls or other equipment.

7. *Loss of power*—May be due to low voltage or low power factor. Sell power factor correction equipment or new motor circuit wiring.

8. *Relays tripping frequently at starting*—May require a larger motor, a motor designed for higher starting torque or a reduced voltage starter.

9. *Frequent fuse outages on power circuits*—May indicate excessive starting currents. Sell motors designed for lower starting current, reduced voltage starting equipment or more adequate feeder capacity.

10. *Low power factor*—May be motors rated in excess of the load. Sell motors fitted to the load or high power factor types for system correction.

11. *Exposure to abuses*—Such as excessive moisture, dirt or dust, explosive gases or mechanical injury. Sell splash-proof, totally enclosed or explosion-proof types of equipment.

12. *Incorrect speed reduction*—Where the controller does not provide sufficient speed reduction, or the motor-to-load balance may be over-powered, or the speed control is incorrectly rated in respect to the motor.

There are also many symptoms of trouble in control apparatus that point the way to the replacement of present equipment. For improved contacts and operating mechanisms and new auxiliary controls present a wide field for sales. Therefore, also look for—

13. *Excessive wear*—Where equipment designed for light duty service has been pressed into heavy service, sell heavy duty equipment.

14. *Controllers operating hot*—May be caused by a defective coil, inadequate spring tension or worn contacts or the controller may be undersized for the load or ventilation may be poor or the power factor may be low. Sell a new controller with modern contact mechanisms and proper ventilation.

WESTINGHOUSE

THE LINE OF PROFIT

Here is the line of packaged control that lifts you out of low priced competition — gives you the edge in features and advantages, identifies you with high quality electrical work.

COMBINATION LINESTARTER

ALL NEEDED DEVICES IN THE MOTOR CIRCUIT IN ONE EASILY INSTALLED PACKAGE

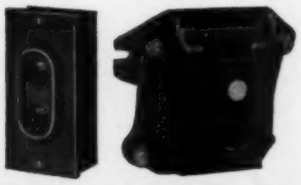
1. Magnetic Motor Starter (push button operated).
2. Manual Disconnect Switch.
3. Motor Overload Protection.
4. Nofuze Circuit Protection.

Safety interlock protects workmen from accidental contact with live parts. Easily and quickly mounted on machine panel or wall. Saves conduit, saves wire, saves labor cost. Gives your customer dependable motor starting, saves him lost production time due to fuse outages. Recommend the Westinghouse Combination Linestarter and identify yourself as the contractor who is right up to date.

PUSH BUTTONS

ALL SIZES AND MOUNTINGS
EXPLOSION-PROOF • DUST-TIGHT

Westinghouse Push Buttons are stocked by your nearest Westinghouse Wholesaler, the size and type you need delivered on the job when you need them.



Westinghouse

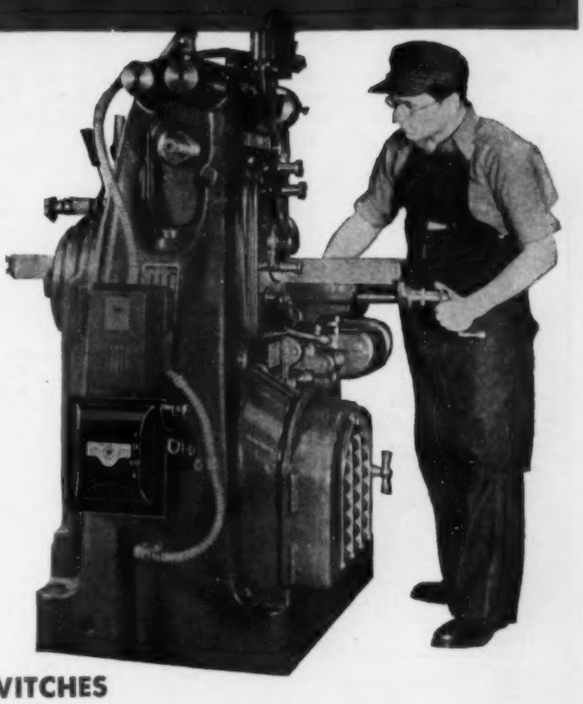
MONEY MAKERS

MAINTENANCE REDUCING FEATURES JUSTIFY THE USE OF A GOOD SWITCH

When you bid on the lowest price switch, whether or not you will get the order depends on how little profit you'll take. To protect your profit recommend the Westinghouse Safety Switch. It costs no more than other good switches yet it has features that will break down a strictly price bid.

- diamond pointed jaw and extended blade confines arc to noncurrent carrying parts.
- one-piece copper construction reduces heat loss.
- "De-ion" arc quenchers in 575 and 600 volt switches prevent dangerous flashover, prolong contact life.

Protect your profit with these features in the Westinghouse Safety Switch.



WESTINGHOUSE SAFETY SWITCHES

"DE-ION" MOTOR WATCHMAN

A low-cost manual starter for motors up to 7½ hp:

- Toggle switch indicates "On" "Off" and "Tripped" positions.
- "De-ion" Arc Quenchers protect from flashovers, prolong contact life.
- Safety interlock prevents accidental contact with live parts.
- Bi-metal disc relay protects motor from overload.
- Knockout space in top, sides, bottom or back of case.

J-20821

• FOR YOUR CUSTOMERS BOTHERED WITH FUSE OUTAGE DELAYS

Here is the answer for the customer who is bothered with production time losses due to fuse outages. The Nofuze Circuit Breaker provides positive circuit protection without fuses. Plants report savings as high as $3,000.00 from Nofuze installations.

NOFUZE CIRCUIT BREAKERS

Packaged Control

15. *Pitted contacts*—May be from excessive current from over-loading and low power factor, or sluggish operation. Sell modern equipment.

16. *Welded contacts*—May be caused by excessive momentary overloads, inadequate spring tension or neglect of previously pitted contact fingers. Sell heavy duty equipment capable of handling tough loads.

17. *Excessive arcing*—May be due to low power factor or equipment inadequate for the load. Sell modern control with adequate arc quenching features.

18. *Sluggish operation of contactors*—May be due to low voltage, improperly mounted control, infrequent operation or inadequate maintenance. Sell adequate feeders and regular maintenance of equipment.

19. *Burned-out resistors* — May be caused by excessive loads, incorrect tapering for the type of load, or poor ventilation. Sell a properly rated and designed controller.

20. *Dirty mechanisms*—May need control enclosures designed to protect the equipment. Sell a new controller with a correctly designed protective enclosure.

21. *Accidental operation of controllers*—May show need for proper safety precautions. Sell totally enclosed types and safety locks.

These major symptoms of motor or controller trouble often point to bad conditions far remote from the apparently offending equipment. When they show up on testing instruments it means trouble ahead, or inefficiency, or excessive operating costs. In any case it calls for immediate action to correct the condition. And, that is time to sell new apparatus.

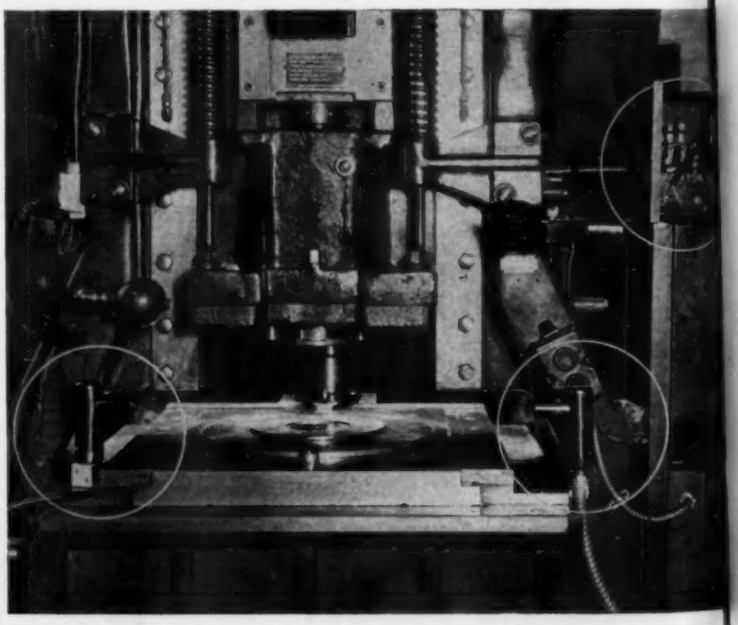
SOME INDUSTRIAL CONDITIONS AND APPARATUS NEEDS	Excessive Grit and Dust A	Splashing or Dripping Water B	Corrosive Fumes or Liquids C	High Temperatures D	Hazardous Areas E	Precision Speed Controls F	Sequence Operation or Interlocks G	Localized Controls H
Abattoir (Slaughter House)	...	X	X	...	...	...	...	...
Automobile Manufacturing	X	...	...	X	...	X	X	X
Bakeries	...	X	...	X	...	X	X	X
Breweries	X	X	...	...	...	X	X	...
Canneries	...	X	...	X	...	...	...	...
Chemical Plants	X	...	X	...	X	X	X	X
Clay Products	X	...	...	X	...	...	...	X
Cold Storage Plants	...	X	...	...	...	...	...	...
Dairies	...	X	...	X	...	...	...	...
Distilleries	X	X	...	...	X	X	X	X
Dry Cleaning and Dyeing	...	X	X	...	X	...	...	X
Feed Mills	X	...	...	...	...	...	...	...
Food Processing	...	X	X	X	...	X	X	X
Foundries	X	...	...	X	...	X	X	...
Garages	...	...	...	...	X	...	X	...
Garments-Boots, Shoes, Hats, Clothes	X	...	...	...	...	...	...	X
Gasoline Stations	...	...	...	...	X	...	...	...
Glass Works	X	...	...	X	...	...	X	...
Grain Elevators	X	...	...	...	X	...	X	X
Ice Plants	...	X	...	...	...	X	...	...
Laundries	...	X	...	X	...	X	X	...
Leather Manufacturing	X	X	X	X	...	...	...	...
Machine Shops	X	...	...	...	...	...	...	X
Mattress Factories	X	...	...	...	X	...	...	X
Meat Packing	...	X	X	X	...	...	X	X
Milling	X	...	...	...	X	X	X	...
Oil Refining and Bulk Stations	...	...	...	...	X	...	X	...
Paint Manufacturing	X	...	X	X	X	X	X	X
Paper Box Manufacturing	X	...	...	...	...	...	...	X
Paper Manufacturing	...	X	X	X	...	X	X	X
Printing Industry	...	...	...	...	...	X	...	X
Pyroxlin Plastic (Celluloid)	...	X	X	X	X	X	X	X
Rayon Plants	...	...	...	X	X	X	X	X
Rubber Products	X	...	...	X	X	X	X	...
Sheet Metal Works	...	...	...	...	...	...	...	X
Soap Manufacturing	...	X	X	X	...	...	...	...
Steel and Iron Mills	X	...	X	X	...	X	X	X
Structural Steel Fabrication	X	...	...	...	...	...	...	X
Tanneries	X	X	X	X	...	...	...	X
Textile Mills	...	...	...	...	...	X	...	X
Tobacco Products	X	...	...	...	...	X	...	X
Upholstering	...	...	...	...	...	...	...	X
Warehouses, Commission and Produce	...	X	...	...	...	...	...	...
Woodworking	X	...	...	...	...	...	...	X

WHAT TO SELL—

A. Totally enclosed, fan-cooled motors
B. Splash-proof motors
C. Enclosed specially treated windings
D. Heat resistive insulation
E. Equipment approved for use in class 1, 2, 3 or 4 hazardous areas
F. Special motor, control and drives
G. Control and instrument applications
H. Extra control stations and safety devices

Let Them Help You Sell

These local resources of knowledge, experience and skill are available, if you will call them in.



INDUSTRIAL SAFEGUARDS *through the use of photo-tube devices can be sold in all kinds of plants. Here the punch press operator cannot operate his machine while arms . or hands block the light beam.*

THERE is a fine reservoir of skilled assistance to use in selling motor and control apparatus that is waiting to be tapped by the contractor. For in every community power companies, wholesalers, manufacturers agents, inspectors and insurance company men are ready and willing to back up any program of modernization.

1. *The Power Sales Engineer* of your local utility has a big fish to fry when the prospective sale means additional load for the power company. He is ready to

Here's all you do!

THE NEW WESTON CLAMP-AMMETER

...instantly reveals costly power losses

Close jaws around conductor
Read current
For insulated or non-insulated conductors, up to 2" dia.
6 current ranges 10/25/50/100/250/500 amperes. Higher ranges on special order.
Sturdy Bakelite construction. High insulation protects operator and prevents short circuits.

With the machinery running, just hook the jaws of the WESTON AC Clamp-Ammeter around the conductor and take a current reading. There is no production interruption as no circuits are disturbed. » » » This simple test procedure quickly checks for possible costly power losses and thereby assures full utilization of power all along the production line. If waste occurs at any point... whether due to bearing friction, tight belts or misaligned shafting... it instantly reveals itself in increased current and the trouble can be corrected immediately. Otherwise, these small losses continue to grow and accumulate ... taking a heavy toll in power, in equipment maintenance and inefficient operations. » » » Some of the outstanding features of this useful though inexpensive maintenance tool are listed at the left. Other features and advantages are given in bulletin form. Be sure to send for your copy. Weston Electrical Instrument Corporation, 672 Frelinghuysen Avenue, Newark, New Jersey.

Tools for efficient maintenance... the WESTON Clamp-Ammeter and the Junior Voltmeter.

WESTON *Instruments*

place the added weight of his company's experience and engineering counsel behind your selling. Give him a break in his load building by backing up his sales story and he will cooperate closely with you. But iron out all differences of opinion with him before he contacts the customer. Decide on a common approach.

Power company men will not be enthusiastic when your sales campaign is built solely on efforts to reduce power bills. But they will cooperate heartily in any effort that will give the customer more for his money, because it creates good will and customer satisfaction for the power company.

The best time to call in the power salesman is immediately after you have contacted the customer and aroused his interest. So lay out your sales plan ahead of time, so that if the customer calls in the power company independently you will be working along the same lines.

2. *Electrical Wholesalers,* even in the smaller cities, often have a salesman specializing in motor and control apparatus. Where the job involves the sale of new equipment in lines they handle, they have a strong motive for giving you all the help they can. These men may be very useful in closing the deal.

3. *The Manufacturers Agent* should be called on as early as possible to work out details of the apparatus that is to be provided. Select your manufacturer and use his equipment down the line and your sales effort will have the backing of this manufacturer's industrial advertising and good will. His engineering resources will be available to you. And when the local agent is assured of an order, if you get the contract, he will back you 100 per cent.

4. *The Electrical Inspector's* aid should be used very judiciously. If you encounter evident violations of the Code on the prospective job, it is best to first discuss the conditions with the owner. Then ask his permission to get an opinion from the local inspection department. Most plant managers will not knowingly risk defective wiring. But they may doubt the importance of your recommendation for rewiring, unless it is backed up officially.

The best approach in seeking the aid of the inspector is to arrange an "unofficial" conference with the owner and the inspector, in which the conditions may be discussed in a friendly fashion and the inspectors advice registered with the owner without making a formal inspection. The use of high pressure in getting the inspector into the plant, on a pretext to give him the opportunity to issue a condemnation on wiring or equipment, may get an order from some hard boiled buyer. But it won't make friends.

5. *Insurance Company Experts* will also help at times. When your prospective job involves features of improved safety it will often be smart to call them in. Frequently, the installation of additional safety features will result in a reduction in insurance premiums for the owner, which can be used to good advantage in strengthening your sales approach.

Selling The Customer's Organization

It pays to contact these other men who can either help or hinder.

STEERING your selling efforts through the customer's organization takes a measure of diplomacy. Thorough acquaintance with plant staffs and their problems is of first importance. And it pays to chart your course carefully to avoid setting up friction within the organization you are trying to sell. Here are some suggestions—

1. *Smaller Organizations*—Here you will probably do business directly with the owner. Try to also tell your story to one or two key employees who are likely to benefit from the equipment you are planning to sell. Point out how it will make their work easier, safer or more uniform, as the case may be, so that they will be primed favorably if the boss calls them in to get their opinion.

2. *Average Organizations*—Much of your sales efforts may be directed at the purchasing agent. But where your recommendations effect a particular department, arrange your conference to include the head of that department, the shop superintendent or others who are immediately concerned with the operation of the equipment under discussion.

3. *Large Organizations*—Where there is an electrical maintenance department, your sales effort must start with the chief electrician or his immediate superior, the plant superintendent. After developing their interest, a conference with the plant purchasing department should be arranged with their help as soon as possible.

4. *Line up Key Men*—The importance of lining up the key men in your customer's organization cannot be overestimated. A shop superintendent may have no authority to sign an order, but he may effectively block your sale if he is not in sympathy with your plan. When you do business with subordinates who must go higher up for approval, this method of sales presentation is vitally important.

5. *Sales Presentations*—When you have figured out what the customer ought to have and are ready to talk business, prepare a written sales presentation. This need not be elaborate nor long. Outline briefly and distinctly—

a. What you propose to do.
b. What benefits the customer will derive.
c. Why he should place this business with you.

If your recommendations are the result of instrument analysis, chart your data and conclusions in an easily understandable form and include a non-technical explanation for the layman. This treatment will add weight to the material if it must pass through the hands of an executive

FACT FINDING *plays an important part in power apparatus selling. To know how to correct or improve conditions involves thorough analysis. Here an analyzer test is being made to find out what is going on.*

who knows nothing of electrical terminology. Attach manufacturers' literature and technical bulletins about the equipment you are selling.

6. *Some Extra Touches*—Many contractors prepare their presentations in the form of a looseleaf booklet. An attractive cover is imprinted with the company name, and a space is provided for filling in the name of the customer to whom the proposal is addressed. The written presentation, instrument test forms, manufacturers literature, together with photographs of similar work performed by the contractor, are neatly bound within.

While such a sales presentation is not a substitute for active personal selling, it gives the man whom you are selling adequate ammunition with which to approach his superiors. A well organized, carefully prepared presentation also adds considerable dignity and prestige to your sales efforts and indicates a methodical analysis of the customer's individual problems and needs.

Power Sales Bring Other Volume

When you help a customer with a power problem, suggest other improvements like these.

ANOTHER incentive for selling power apparatus is that it creates important by-product business. The sale of one new motor or drive may lead to extensive re-wiring. Finding the solution to a knotty electrical problem may tap a steady flow of service and maintenance business. So the best part of selling power improvement ideas is that it establishes you on closer terms with more customers, who need your help for other work.

It is your job, of course, to ferret out the places where you can fill the need. There are a variety of these extras lurking around every power sales job, that will roll up increased volume and profit. For example:

1. *Wiring Conditions*—Beyond the essential wiring for a new motor there may be over-loaded feeders and other circuits. Capitalize your opportunity to check all the way to the service for over-loads, over-fusing or other symptoms of wiring inadequacy. Sell the owner on bringing full voltage to the motor terminals.

2. *Extra Control Wiring*—Watch for places to sell additional control stations. Machines which may be operated from several positions need a convenient control button at each point. Look for remote operated control equipment, as for instance, a ventilating system requiring stations at several locations in the plant. Sell more pilot lights, jog buttons and similar features. It means more wiring.

3. *Guards and Enclosures*—While in the plant, check open type control equipment that is subject to excessive dirt and mechanical injury and motors and drives that may be unguarded. Sell pipe rails around motorized equipment, grill work around exposed controllers and switchboards, or metal enclosures for other unguarded electrical devices.

4. *Mechanical Improvements* — When replacing an old motor, check for insecure or unsafe controller mountings, motor base anchors and control station fastenings. These conditions can be turned into additional work and assure the customer's satisfaction with the equipment you are installing.

5. *Accident Prevention*—Keep an eye open for applications of safety stop control. Sell "dead man" or "cut-off" twin buttons that require operators to use both hands to start a machine. Interlocking circuits guard interdependent machinery.

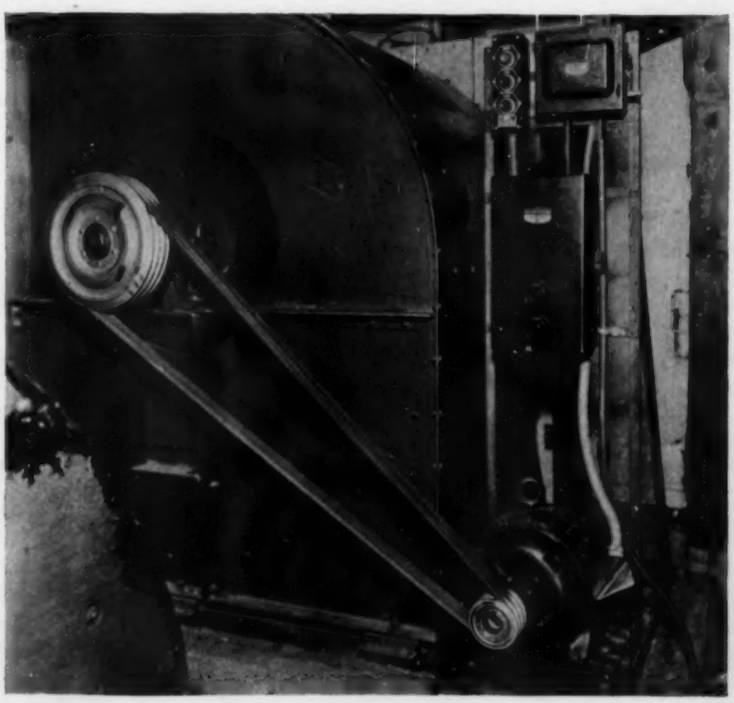
6. *Machine Protection* — Key-operated control stations may be substituted for ordinary push button stations to prevent accidental or unauthorized machine operations. Delicate or dangerous machinery can be guarded by auxiliary control features.

7. *Product Improvement*—Process control, safety factors and operating routine may be improved by the introduction of automatic control devices. Limit switches, trip switches, automatic temperature control, sequence or timed control are available for innumerable applications.

8. *Supervisory Control*—Remotely controlled feeder contactors, for protection against accidental or unauthorized machine operation, are gaining favor as a safety precaution for groups of shop machines. Sell a control station in the superintendent's office to provide supervision over machines handled by inexperienced or apprentice operators.

9. *Machine Lighting*—Watch for opportunities to install local machine lighting, firmly and conveniently mounted on machines.

10. *Maintenance Service*—If there is no regular maintenance staff in the plant, check up on the conditions of other motors and controllers and sell a routine maintenance contract. Point out the advantages of having a skilled man go the rounds every month or so to keep machinery in order.



QUIET OPERATION *is often important when selecting motors, drive, base and control, as with this hotel's fan drive. Modern devices for checking vibration are helpful in such cases.*

Earl Whitehorne, Editor

Show Them The Danger—

Electricity, in so far as it concerns the wiring in our homes, is so familiar and apparently so safe, that the average youngster thinks no more of replacing a fuse than his forefathers did of filling a lantern. But the idea is going too far. Many people think that wiring is so safe inherently, that it doesn't make much difference who installs it.

An apprentice who got to feeling his oats, after working for six months as a helper, decided to take some house jobs on his own because he knew everything. One day he dropped his pliers, grounding a live service terminal. When he came out of the hospital he went back to work as an apprentice.

We have seen many nice, quiet demonstrations of the effects of inadequate wiring, horrible examples, and so on. But, what we would like to see is a good husky demonstration for the public of what happens to the best of wiring materials when there is no properly installed fuse to clear the circuit. It wouldn't scare anyone away from using a flat iron. But it might bring about a new low in home electricians.

Is This Proper?

In setting up prices for farm wiring on the lines of a middlewestern co-op, the customary procedure was followed. All persons interested in wiring were called into a meeting. The need to establish a price schedule, was explained to them by a representative of REA.

According to the report of one of the contractors present, when representatives of established local concerns protested at the very low prices that were being scheduled, the REA representatives swung the rest of the meeting into line by warning them that a big contractor in a neighboring city would be glad to take all the work in the area at those prices. But later inquiry around that city showed that there were no contractors, of the financial caliber necessary to swing such a project, even remotely interested in farm wiring activities.

Any buyer can get cheaper prices by such tactics. The speculative builder learned it long ago. But the net results is to discourage competent contractors from taking on the work. The speculative builder doesn't care—but we have every reason to believe that REA does. For after all, these co-ops have to pay off from now on. These strong representatives should be disciplined.

More Men for More Calls

A new chief electrical inspector in an eastern city fell heir to a good local ordinance. One rule requires reinspections once each year in schools, hotels, theaters and hospitals. There are about 5,000 buildings of this class in that city. But only 500 of them have been checked since January 1938. Another requirement calls for the examination and approval of electrical layouts before permits are issued. This work is also way behind. There is not enough manpower.

Both of these laws were sponsored by electrical men acting in good faith. But they are not workable with an inadequate inspection staff. It takes more men to make more inspections. Inspection departments must face this fact. And electrical men in each community should help them get the necessary extra personnel.

Watch This Labor Plan

Under Wisconsin's plan of unemployment insurance, employers pay into an individual account from which his unemployed workers are paid. This plan, which may be adopted in other states, provides a powerful incentive toward stable employment.

To benefit by it, smart plant managers will be smoothing out production line labor demands and, reorganizing maintenance and construction forces to avoid employment peeks and resulting lay-offs. That means that contractors will be called in for more construction, emergency and change-over work.

Dealer's Choice

A midwestern wholesaler was thumping a tub over the shortcomings of his contractor customers. Through active sales work in the territory, his boys had pushed up their industrial business to pretty percentages. But the contractor business showed no such increase. This proved conclusively to him that, if the wholesaler wanted to make more profit, he ought to lay off the contractor trade and chase the smokestacks.

Smart? Well, let's consider.

Some wholesalers who are dealing with large industrial plants and electrical contractors on the same basis lose sight of a vital distinction between these two types of customers. But the industrial customer is a consumer, he buys for use. The contractor buys for resale. Some re-sell to industrials.

When a manufacturer's representative takes an order from a contractor, he asks the contractor to designate the wholesaler through which he wants the goods shipped. The wholesaler is protected. And if the wholesaler wants to develop the contractor's business as a more profitable effective line in distribution, he would do well to adopt a similar policy. And many contractors can build themselves into this position if they want to.

These "Learners"

Organized apprentice training in factories stopped early in the depression. But ten years is a long while. Many old men have quit. No young men have been prepared. So as volume has grown at times and places,

management has tried a short cut.

Having no time to put recruits through a full apprentice training, they are taking on "learners" and showing them quickly how to run one machine. It means at least temporarily a larger proportion of unskilled help, more need for safety provisions, and automatic control and better lighting. And this brings opportunity to electrical contractors.

A Word From The Women

When the gals gather around on Tuesday afternoon they don't waste much time discussing the electrical contracting industry. But one such gathering in Chicago got to discussing electrical gadgets. The flow of words washed up the following three little items for your next house job.

1—A plug receptacle at every switch-plate for the vacuum cleaner. With modern combination devices this is an easy one, doesn't cost much and has a strong sales appeal.

2—A permanent box for Junior's toy transformer. A flush box in the playroom that leaves only the low voltage terminal and control exposed to the children's ingenuity.

3—A daylight make-up light for the bathroom and dressing table. They want a light for making up that will give them a fair idea of what they are going to look like when they get out of doors in the daytime. This, of course, means a fluorescent daylight lamp.

Little Job Plus Salesmanship

Before you look down your nose in scorn at that little order to "repair doorbell" heed the story of R. D. Speers of Davenport, Iowa. A customer said that his doorbell wouldn't work. Sometimes it did and sometimes it didn't, anyway he wanted it fixed. He was duly warned that there might be some expense in finding out where the trouble was—to which he grumbled acquiescence. Before the job was finished there was a new annunciator installation, complete rewiring of the bell and buzzer system and modern chime doorbells for which the owner gladly paid a bill of nearly $170.

That is salesmanship. Beyond a question of doubt a bill for $9 or $10 for shooting trouble on the old doorbell circuit would have brought back a wrathful protest. Yet, a little salesmanship and a thorough modernization job costing many times as much made a pleased and happy customer.

High Cost of Controls

There is a lot of splendid field work being done by power company sales people in opening up good lighting business. Contractors should actively cooperate with them in carrying through these installations.

But there are still too many over zealous contestants for utility company load building prizes, who will endorse most anything the customer fancies. A recent case was a 500 watt indirect fixture, flooding a very dark store ceiling. It brought a kwh increase only until it was thrown out. And some power company warehouses contain a lot of this repudiated equipment.

This is bad for the electrical contractor as well as the power company. It hurts the lighting business. And where it happens too much the facts should be taken to some one up top.

Back Talk

The Man Is Right

To the Editor—"I have just finished looking over the April *Electrical Contracting* and find this Specifications issue very interesting and valuable. In the section on wiring for apartment houses, I find an error in computing the size of feeders from service equipment to meter bank. The total computed load is indicated as 28,640 watts and should be 40,440 watts. If I am correct, the total amperage would be somewhere around 175 and size of wire about 3/0.

"Please do not misconstrue this to be any criticism. This is one of the best issues you have ever come out with. It contains a host of valuable information."

N. C. Christopherson, Supt. of Range Sales Wisconsin Electric Power Co., Milwaukee.

Thank you, Mr. Christopherson, for pointing this out. We are distressed that this error in addition got by us. We are glad to be able to warn our readers who may have saved the issue for reference, so they may note the correction on page 41 of the April issue.

Regarding Resentment

To the Editor—"I noticed your editorial calling attention to the unfairness of distributors selling direct to industrials at contractor prices. While we all know this is an evil to be corrected, your story was just a little drastic. While probably true, the general tone of your editorial would certainly not tend to build up pleasant and profitable relations between the jobber and the contractor.

"In this city, the jobbers have been trying to work out a plan which would protect the contractor as much as possible. We hold various meetings toward establishing better relations. I was not at all surprised when one of the contractor members recited your wire story to us as an example of what was going on.

"Your magazine goes to many contractors who are inclined to jump at an excuse for criticising the jobbers without regard to right or wrong. I believe your editorial was a little far fetched and apt to do harm. I found that the same idea is held by wholesalers in other cities with whom I have recently talked.

"You serve both the contractors and the wholesalers, and I am sure you want to help bring about the better relations which all of us are anxious to bring into the picture."

Claude W. Johnson, President, The Johnson Electric Supply Co., Cincinnati.

The March editorial "Try Resentment" was a frank statement of an actual occurrence, where a wholesaler quoted the contractor's large quantity price to an industrial on a very small order. This weak kneed practice, we think, is bad and should be frankly discussed. It is true that this may stir up bad memories in the minds of contractors and re-awaken some bad feelings. But if both wholesalers and contractors will agree that this sort of thing should stop, it can be stopped in any city.

Public condemnation and resentment against any manufacturer or wholesaler who scalps discounts will soon stop the practice. Every wholesaler, we believe, would be glad if his competitors would quit it. He would be glad to quit also. But you cannot get far in promoting better trade relations, as long as somebody periodically kicks the bucket over and spills the cream.

We appreciate your frank criticism, Mr. Johnson. But we still believe that these offenses against local trade ethics call you open condemnation. And the wholesaler can take leadership in it. It will be profitable to him.

Thank You! Thank You!

To the Editor—"This fellow in Sebetha, Kans. (See Page 150, April issue) spoke my sentiment. But I don't give all the credit to your Electrical Buyers Reference. Someone is sure burning some midnight oil on the best magazine in my collection—*Electrical Contracting*.

"Questions on the Code should be used more but I suppose all the boys are like I am. They would rather read them than write about them. My few lines to tell you that you have two darn good books."

Elmer Edgell, McPherson, Kansas.

What you say, Mr. Edgell, just naturally makes us purr. If this paper is helpful to the contractor, it is worth all the work. And the same goes for the Buyers Reference.

He Likes It Too

To the Editor—"Your April number featuring 'Electrical Specifications', is to my mind one of the best issues you have ever published. I want to congratulate you and your staff on this excellent work. Looking it over as a former contractor, I could find in this number every possible aid needed for designing and selling all types of building wiring. And you have presented your data in a very readable manner.

"This number should also have almost as much interest for the architect and engineer who designs electrical installations as for the contractor who must install them. I hope you have given this number the widest publicity."

A. Penn Denton, Consulting Engineer, Rigid Steel Conduit Association, New York.

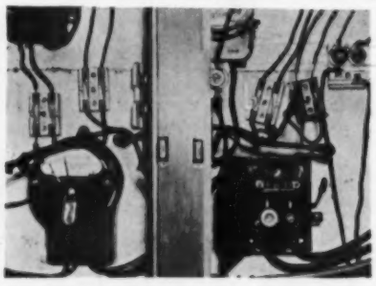
We note this comment as typical of many letters that have brought us gratifying endorsement of this review of design procedure and specification writing. It was thoughtful of you to say this, Penn, and we appreciate it. We too believe that consistent use of this classified outline will assist any contractor toward better specification writing and better profit.

WIRING Methods

RELIEF FOR SERVICE HAZARDS

Here is a sample of conditions that await correction in many small buildings. The photographs are from E. W. Adams Electrical Service of Butler, Indiana, and this is what this contractor has to say about the modernization work involved—

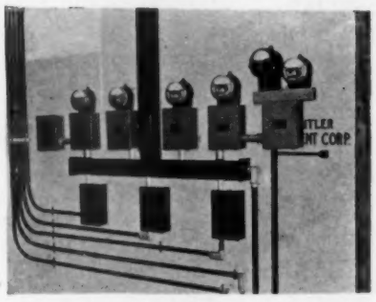
"I am sending two pictures of an old and new service entrance I completed recently. The old job was built up in a wooden box and lined with ⅛ in. asbestos. It had a 60 amp. knife blade switch with one old 100-amp. wire fuse, 2 wire type, and 6 meters fed in from this.



LOAD TROUBLES came fast when this antiquated equipment was patched up for additional light and power requirements.

"Last spring the building was remodeled and the load was increased. I advised them at that time to put in a new service entrance. But they said the old equipment had always worked all right and for me not to bother. When more light and power was required during the winter months, things began to happen and fast. At that time the light company engineer was called in and he advised them to have the new service installed. I installed the new service and balanced up the load."

This contractor's comments suggest a procedure for other towns. When services become inadequate or hazardous as the "before" view plainly shows, get the inspector to work with you. If there is no inspector in your town, call in the lighting company engineer. He will help you to sell relief for service hazards, and support your recommendations for installing a safe and adequate job.



HAZARDS REMOVED by this modern equipment after contractor and power company engineer teamed up for the clean-up.

SAVING SPACE FOR HEAVY CHANGEOVERS

The commercial district of Springfield, Mass., is gradually being changed over to 3-phase 4-wire underground network distribution, which requires various contractors to make the most of crowded space conditions. Helpful in this connection is the use of large externally operated switches which also accommodate the current transformers used for metering heavy loads.

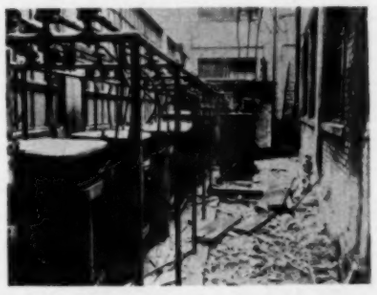
An installation recently made by the Springfield Electric Company for a furniture store includes a 600-amp. main service switch at the left. On the right is a 400-amp. switch which controls the store lighting. Mounted within this switch are three current transformers of 150-amp. capacity for metering this load. The service conductors were brought into this building through an 18 by 24 by 12-in junction box and extend without splices to the terminals of the main switch. From the main switch the contractor routed conductors to other metering switches located elsewhere in the meter room.

COMBINATION CONTROL of heavy metered loads provided by meter switch that also houses current transformers.

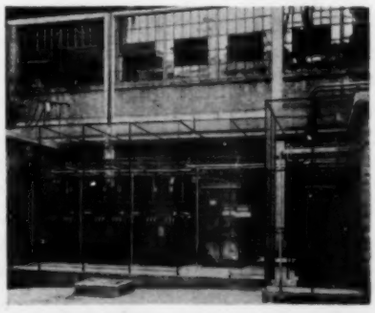
MODERNIZING TRANSFORMATION

Years of exposure and steadily increasing loads created an ideal setting for modernizing the transformer station of Whitman and Barnes, Inc., small tool builders of Detroit. Here the "before" view shows how various stages of adding on, to make a final assortment of nine transfomers, left much to be desired in the way of safety and efficiency. The first of these transformers were installed about 1908.

The new station shown in the "after" picture represents a $22,000 replacement



WANING POWER—How an outgrown and badly wired industrial transformer station looked before it was scrapped.



NO HAZARDS—New station for power, welding and lights, with power factor correction, all arranged for safe heavy-use service.

job which was engineered, furnished and installed by the Miller-Seldon Electric Company, after extensive surveys were made. Conditions revealed by tests showed two places where welding feeders had a 15 per cent drop and a 65 per cent overload. The power factor

49 YEARS OF FINE SWITCHMAKING

reflected in this New Switch

ARROW

Double Pole, Double Throw
3 Positions, 2 Circuits

Provides convenient flush control for two-speed motors, such as attic fans, blowers, etc. Gives any two-circuit connections for permanent and auxiliary lighting, or dark room control of colored and bright lights.

Switch has positive OFF position in the center. It is impossible to switch from one circuit to the other without stopping at the center, and again moving the switch lever to the second position.

Due to the length of throw necessary for the switch lever, Plate No. 4362 with extra long opening is required.

10 Amps. 250 Volts; 20 Amps. 125 Volts

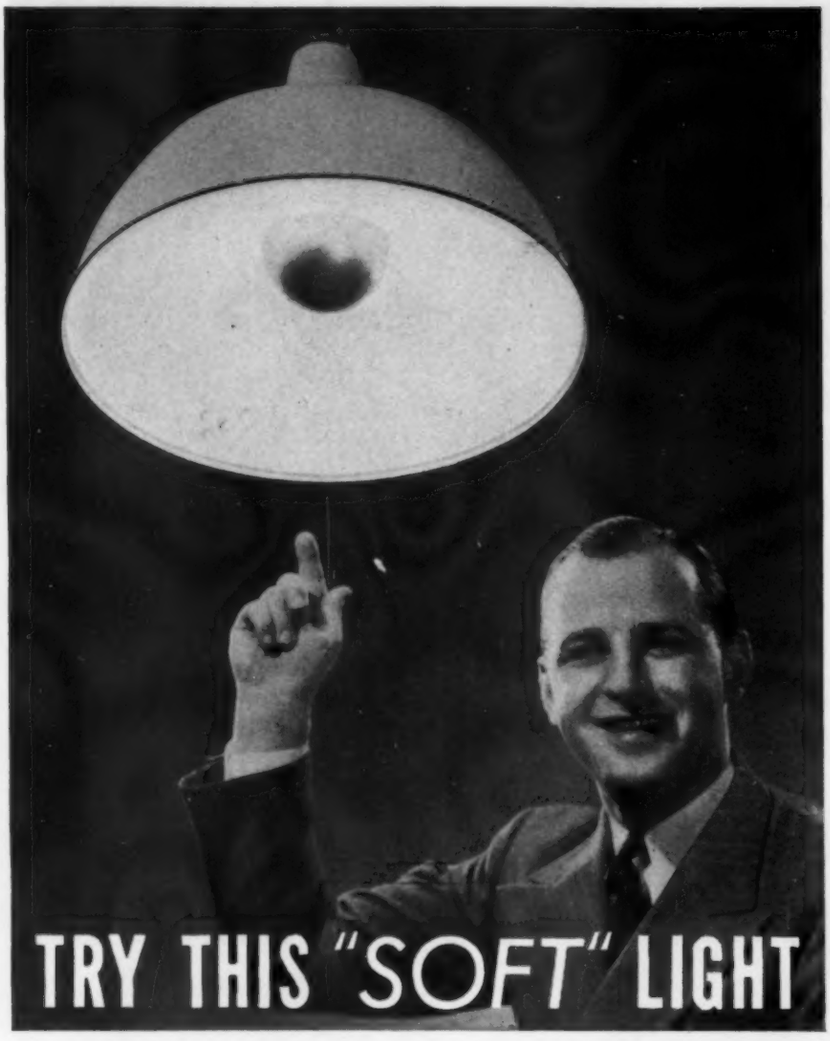
Cat. No.	Description	Std. Pkg.	Carton	Pkg. Wgt.
4361	Bakelite Switch	10	2	9
4362	Brass Plate, .060"	10	2	8

Plate No. 4362 must be used with No. 4361.

ARROW ELECTRIC DIVISION

THE ARROW-HART & HEGEMAN ELECTRIC CO.

HARTFORD, CONN. MAKERS OF ELECTRIC SWITCHES SINCE 1890



We know that harsh illumination is a real hazard—that eyestrain causes headaches and impairs efficiency. That's why we designed this new fixture, using bowl-silvered lamps—where all the seeing light is reflected light, properly diffused—"soft"—to minimize shadows. There's no harsh glare. Try it, and you'll be convinced.

THE DOME DIFFUSER
by Goodrich

Note, at left, how all illumination is indirect—diffused—glare-proof. Light wasted in the neck of most reflectors is here directed to the ceiling, eliminating sharp contrasts and brightening the whole interior. Good illumination is your lowest cost production tool. You can't afford anything but the best. Write us for information.

GOODRICH
ELECTRIC COMPANY
OFFICES IN ALL PRINCIPAL CITIES
GENERAL OFFICES AND FACTORY: 2902 NORTH OAKLEY AVENUE, CHICAGO, ILLINOIS

WIRING Methods

[FROM PAGE 38]

was 65 per cent, while after modernization it was 98 per cent. Some transformer cases were badly rusted away, windings were grounded, and both primary and secondary wiring was in shaky condition.

Changeover operations were so planned that the plant's 24-hour operating schedule was not interrupted. This work included the construction of a new primary switch house (right), and secondary switch house (left), mats and bus structures for three 200 kva., 4600/220-volt power, two 150 kva., welding, and one 150 kva., lighting transformer. A 120 kva., outdoor type capacitor unit was provided, which appears in the center background.

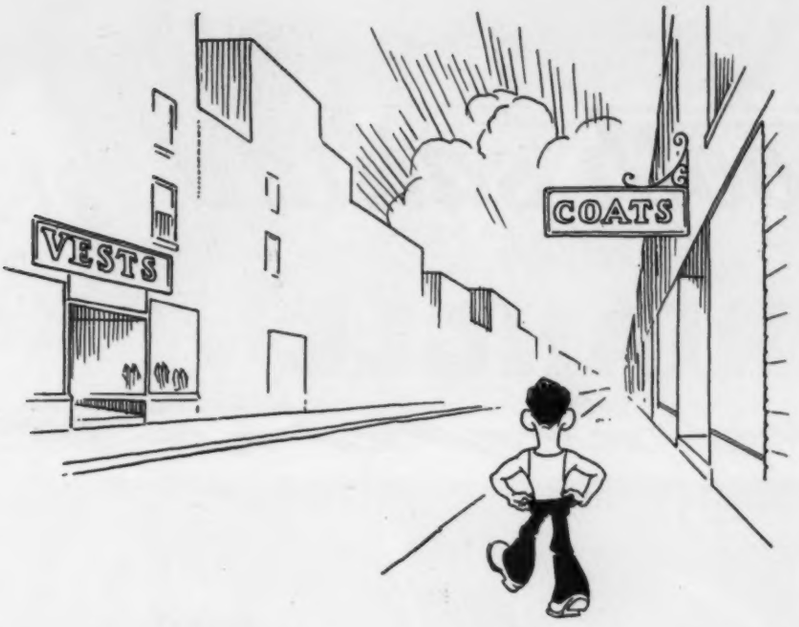
LADDER STORAGE

Conduit and ladders are handled in a minimum of space at the brand new shop of Salinas Electric Company, Salinas, Calif. Along the concrete wall, adjacent to the alley entrance, the ladders are stacked as shown in the picture and the conduit right next to them. Places of conduit embedded in the concrete provide the separation for the different sizes of pipe. Long extension ladders are suspended from the ceiling on rope

SPACE SAVING—A close up of pipe and ladder storage in the new shop of the Salinas Electric Co., Calif.

over pulleys. An overhead crane, power driven, is used both to help load heavy materials onto the trucks and to operate an ingenious elevator lift on castors from the basement storeroom.

W. D. Evans and his son operate this pioneer electrical contractor-dealer establishment, established in 1908. The new store incorporates excellent merchandising features and provides a compact shop for the large wiring business done in the Salinas Valley.



Why Shop Around?

● **You would hardly buy a suit of clothes by going to one store for the trousers . . . to a second store for the vest . . . and to a third for the coat. But, by buying the entire suit from one reliable store you know you can get what you want.**

Then why shop around for your electrical supplies? The T&B Distributor has everything you need, and he delivers the *right* material at the *right* time, in the *right* quantities, *right* on the job.

T&B Products are sold only through T&B Distributor Facilities. Make use of the "T&B Plan" . . . you will eliminate time-taking expensive "shopping around" and avoid the hazards created by inferior electrical supplies. But most important . . . you will always know *where* you can get *what* you want when you need it.

This is the FIRST

A series of advertisements designed under the T&B Plan to set forth the economic reasons for the fixed T&B Distributor policy.

***The* T&B DISTRIBUTOR SERVES and SAVES**

THE T&B DISTRIBUTOR SAVES YOU MONEY BY:

Reducing estimating costs.
Functioning as Purchasing Agent.
Delivering on schedule.
Meeting emergency demands.
Saving Handling Costs.
Supplying quality products.

THE THOMAS & BETTS CO., Inc.

MAIN OFFICE and FACTORY — ELIZABETH, N. J., U. S. A.

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EXPORT DEPARTMENT — BROOKLYN, NEW YORK

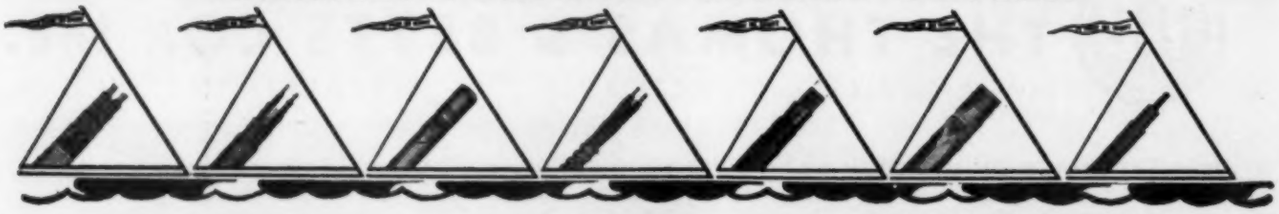
ELECTRICAL FITTINGS SPECIALISTS SINCE 1899

IT MUST BE RIGHT

smooth sailing with TRIANGLE

TRIANGLE PRODUCTS GO PLACES

TRIANGLE PRODUCTS REWARD BUYERS!



TRIANGLE CONDUIT & CABLE COMPANY, INC.

Horace Harding and Queens Blvds.
Elmhurst, New York City, N. Y.

ELECTRICAL

Maintenance

INDUSTRIAL AND COMMERCIAL

GUIDE SHEETS EXTENDED

SOME eighteen months ago we began here this series of so called "Maintenance Guide Sheets." The idea was to review the important equipment with which the electrical maintenance man is working and point out the principles involved in its selection, application and care. The purpose was to make available, in convenient form, the background knowledge of this diversity of equipment, together with trouble finding charts that might be held for reference in emergency.

The original intent was to complete this review next month with a chapter on electronic devices. But so many favorable comments have been received, supporting a broader coverage of the maintenance theme that seven more chapters have been added to round out this discussion.

This series of articles began in January, 1938, with a frank review of the electrical maintenance man's job. Then came—

1. Alternating Current Motors—Types and Applications
2. Direct Current Motors—Types and Applications
3. Alternating Current Motors—Maintenance
4. Direct Current Motors—Maintenance
5. A.C. Motor Starters and Controllers—Types and Applications
6. D.C. Motor Starters and Controllers—Types and Applications
7. Maintenance of Control Equipment
8. Special Control Problems—Heavy Installations and Maintenance
9. Electric Distribution — Circuit Protection—Power Factor Correction
10. Lighting
11. Electric Heat
12. Electric Welding
13. Interplant Communication
14. Instruments
15. Power Tools
16. Batteries and Rectifiers
17. Electroplating (this issue)

Coming articles will discuss

18. Electronic Devices
19. Transformers and Circuit Breakers
20. Equipment for Hazardous Locations
21. Wiring Devices and Cables
22. Drives
23. Elevators, Conveyors, Cranes and Trucks
24. Ventilating and Air Conditioning Equipment
25. Management of Maintenance

Electroplating

Maintenance Aspects

ELECTROPLATING is that process used for plating or coating one metal with another, usually a non-ferrous metal. The purpose is to provide a coating (1) for protection against corrosion, and (2) for ornamentation of an article. Frequently an attempt is made to accomplish both purposes by using composite deposits, such as nickel—copper—nickel. But electrochemically the results are not the same.

Parts to be plated are placed in an electrolyte, so arranged that they complete an electrical circuit. They may be suspended from stationary rods over the tank, suspended from a conveyor and passed through the solution at a definite speed, or put in a perforated cylinder which is rotated in the electrolyte.

The usual electroplating plant or department consists of an intimate association between electrical, mechanical and chemical materials and devices. To plan, specify, install and maintain an efficient electroplating department challenges the ingenuity of the plant engineer.

Final costs of maintenance are largely determined in the planning of the plant and in the selection of the equipment. So careful study of the selection, installation, operation and maintenance of the equipment may prevent costly errors being made.

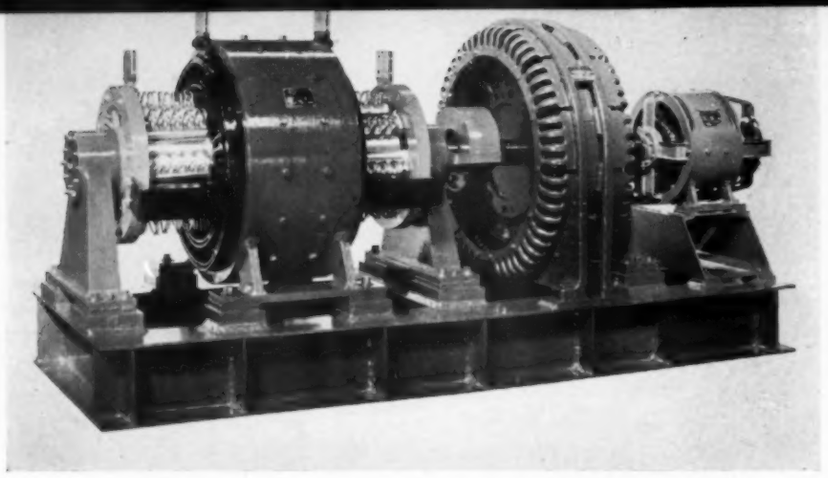
For these processes, it is the duty of the electrochemist or electroplater to specify the amount of current that will be required and the voltage at which it is to be applied to the system. Therefore, this discussion, from the maintenance man's viewpoint, will involve only the electrical equipment necessary to produce, distribute and control the relatively low voltages (3 volts and above) and high amperages (100 amp. and greater) associated with electroplating processes.

The motors and control necessary to perform the mechanical and chemical functions of the plating room are of types, which have been discussed previously in this series of guide sheets.

Source of Power

Electroplating processes require equipment which will furnish direct current

UNIFORM THICKNESS OF PLATE *is assured when parts are passed at a definite speed through an electroplating tank. Load in tank and plating time are constant with semi-automatic or single tank conveyors. (Hanson-Van Winkle-Munning Co. photo)*



TYPICAL MOTOR-GENERATOR SET *for electro-plating process. The set consists of a double-commutator 5,000-amp. 6-volt generator, a 450 r.p.m. synchronous motor, and a direct-connected exciter. (Columbia Electric Mfg. Co. photo)*

at low voltage and high amperage. The equipments for the source of power are storage batteries, generators or motor-generator sets and rectifiers.

Storage batteries are used only for small scale experiments and occasional plating with silver, gold and platinum.

Generators are the most common source of d.c. power, and are specially designed for electrochemical processes. They should be driven by a motor connected to the plant power system. Practically always the combination is a motor-generator set.

Polyphase induction motors are used generally for driving generators having an output up to 1,000 amp. at 6 volts, or in other voltage ratings equaling 6 kw. output. Above those ratings, either induction or synchronous motors may be used. However, for sizes requiring motors of 50 h.p. and larger, synchronous motors should be used, because they have provision for power factor correction.

To enable the electrochemical processes to be entirely free from the variations and interruptions occasioned by the use of shop d.c. power, the generators should be excited from other sources. They may be separately excited from exciters either direct connected or belted to the generator or from separate m-g. exciter sets, whichever is most economical. Some small generators under 1,000 amp. capacity are self-excited.

Double-commutator generators are furnished usually in capacities above 500 amp. 6 volts. With this arrangement both commutators may be connected in parallel for 6-volt operation, in series for 12-volt operation, also for 6/12-volt 3-wire operation. For the 3-wire system, it is essential that the load on both commutators be equal so as to have proper commutation.

The use of shunt or compound wound generators, adjustable voltage generators and line rheostats for the low voltage circuits will depend on the application, number of tanks and voltage for the respective tanks. Recommendations regarding their use should be obtained from reputable manufacturers of electroplating equipment.

Copper-oxide rectifiers may be used as a means of supplying high amperes and low voltage, if the source of power is alternating current. These devices are as complete and as flexible as modern m-g. sets. Where applicable, they offer decided advantages over a m-g. set, such as—

1. Only one moving part, which is a small ventilating fan.
2. No d.c. excitation required.
3. May be connected or disconnected as frequently as required from power lines without causing any surge or disturbance on the power lines.
4. Working voltage available immediately.

With each generator, motor-generator set, and rectifier, a control panel should be provided. The panel should have instruments to indicate the voltage and current at the generator or rectifier, and the exciter voltage for separately excited generators; also field rheostats for exciter and generators. Control for the primary circuits should be mounted neatly and conveniently.

Distribution System

Because of the large current values involved, it is essential that bus bar connections be used, using ¼-in. thick bus bar of the proper width and number. Ample cross section should be provided to avoid overheating of the conductors and to avoid excessive voltage drop.

The size of copper bus bars may be estimated on the basis of one square inch of cross section for each 1,000 amp. to be transmitted.

Since the cooling of bus bars depends upon their surface area, obviously two ¼-in. bars are better than one ½-in. bar. Vertical placement of the bars or running them on edge permits natural ventilation and cooling.

Bus bar joints may be either bolted together or clamped with bus bar clamps. The lap of a bus joint should be 2½ in. minimum. The contact surfaces must be clean and bright, and can be given a thin covering of vaseline. Bolts or clamps should be drawn up to give a unit pressure of approximately 750 lb. per sq. in. The bus and adjacent parts should be cleaned of the surplus vaseline squeezed from the joints and then painted or lacquered to prevent corrosion. All the foregoing apply to joints between sections of buses, and connections to both the generator and tank terminals.

Voltage drop from the generator terminals to the point of application of the current to the tank should not, in general exceed 5 per cent of the generator voltage.

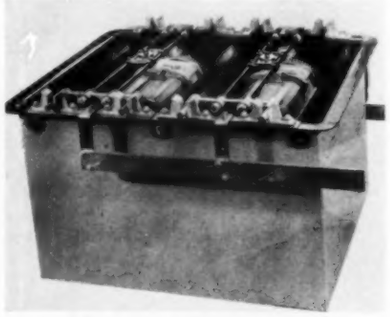
To determine excessive voltage drop, observe if there is excessive heat in any particular joint when full load current is being carried. Furthermore, if the voltage drop across any contact joint exceeds 50 milli-volts, the contacts should be cleaned, properly surfaced and then drawn together under heavy pressure.

When ordering a shunt and ammeter for measuring the ampere load on a generator or rectifier, be sure to specify the length of lead required. When bussing in a shunt, *never* shorten the shunt leads or the result will be a false reading on the ammeter. Shunt leads may be lengthened if the resistance of the replacing longer leads is the same as that of the shorter leads.

Installation and Operation

When motor-generator sets are mounted on the ground, provide a concrete foundation for the mounting of the set and grout it in, following manufacturer's instructions.

Where the sets are mounted on platforms or installed on upper floors of plant buildings, consideration must be given to the location of the set with respect to the supporting columns of the platform or building.



ELECTROPLATING *(Mechanical)—Parts are put in bakelite cylinders which rotate in electrolyte. One or more cylinders, belt- or motor-driven, can be used, depending on size of tank (Mercil Plating Equipment Co. photo)*

MAINTENANCE GUIDE CHARTS ON ELECTROPLATING

TROUBLE CORRECTION CHART

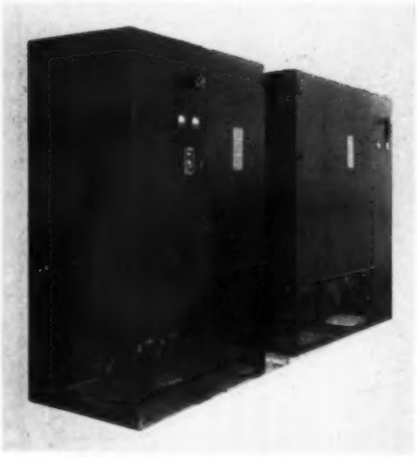
IF THIS HAPPENS	CHECK FOR THIS
Abnormal heating of generator	Poor ventilation — Machine should be located so as to receive good ventilation and be shielded from direct rays of sun. Overload — Check the current with an ammeter and reduce the load if it is excessive. Hot windings — If all armature coils overheat, the generator is probably overloaded. If one coil heats more than the others, the indication is that the coil is short circuited.
Shunt field coils overheat	Supply voltage is too high, or one or more coils are short circuited or grounded.
Sparking, also heating of commutator	Poor brush contact; wrong brush position; brushes sticking in holders; dirty or rough commutator; insufficient or excessive tension on brush holder springs; heavy overloads; high mica or high bars on commutator.
Heating of bearings	Insufficient oil; oil ring not revolving; improper grade of lubricant; grit or dirt in lubricant; excessive load caused by a tight belt.
No voltage at generator terminals	Open generator field or exciter circuit.
Trouble develops with motor, control or rectifier	Refer to respective trouble correction charts.
Bus bar connections heat	Poor contact joints — Clean contact surfaces and draw tight.
Excessive voltage drop between generator and tank	Poor contact joints, indicated by excessive heat — Clean bus bar contact surface and draw up under heavy pressure.
Distribution bus sections overheat	Overload or poor ventilation — Investigate plating process; remove foreign articles from bus or in its immediate vicinity.

COMPARATIVE OPERATING DATA OF MOTOR-GENERATOR SETS AND RECTIFIERS

ITEM	MOTOR-GENERATOR SET	RECTIFIER
First cost	A complete motor-generator set consisting of starter, motor, generator with direct-connected exciter and generator control panel costs less than a complete rectifier.	A complete rectifier includes all a.c. and d.c. control and approximates 10% higher than a m-g set.
Installation costs. (Foundations, inter-unit wiring)	Highest — Approximately 10% of purchase price.	No foundation or inter-unit wiring required.

COMPARATIVE OPERATING DATA OF MOTOR-GENERATOR SETS AND RECTIFIERS

ITEM	MOTOR-GENERATOR SET	RECTIFIER
Voltage Control	Wider — with smoother control than rectifier.	A 6-volt rectifier normally has manual adjustments for 2, 4 or 6 volt operation. Each range sub-divided by means of a selector switch into ¼-volt increments.
Voltage regulation	Approximately plus or minus 3%.	Approximates — 25% on unregulated unit. At higher costs unit can be furnished, where required, with regulation — 6%.
Voltage range	Operate safely at 20% over voltage continuously.	Cannot be operated safely at voltages higher than rating.
Overload ampere capacity	25% for two hours, guaranteed.	None guaranteed.
Efficiency at rated voltage and amperage. (6-volt units only)	In sizes 3,000 amperes or larger m-g sets have the highest efficiency. This advantage increases as the size of the unit increases.	Below 3,000 ampere rating the the rectifier has the highest efficiency. The advantage increases as the size of the unit decreases.
Efficiency at rated voltage — part load in amperes	Efficiency remains fairly high down to ½ load in amperes — below this it falls off rapidly.	Efficiency remains high down to very small loads in amperes.
Efficiency at rated amperes-voltage lower than rating	At output voltages below 4½ volts, efficiency falls off very rapidly.	At voltages below 4½ volts efficiency is much superior to that of m-g set.
Maintenance operations. (In addition to general cleaning)	Lubrication of main bearings. Checking and refacing brushes on motor, generator and exciter. Reconditioning commutators and rings on motor, generator and exciter.	Single-shot lubrication every 3,600 hours.
Life expectancy	Depends principally on: — (1) Loads. (2) Use of proper brushes. (3) Freedom from fumes and dirt. (4) Frequent inspection periods.	Depends principally on: — (1) Loads. (2) Freedom from fumes and dirt. (3) Ambient temperatures.



COPPER-OXIDE RECTIFIERS—*Where applicable, are more efficient than m-g. sets—especially at loads 50 per cent and under—are installed easily and require practically no maintenance. Left—6-volt, 2,000- and 3,000-amp. electro-plating units with voltmeter, ammeter, voltage regulating handle and start-stop push button. Right—rear view of 3,000-amp. unit with side and rear panels of cabinet removed. (Hanson-Van Winkle-Manning Co. photo)*

Rectifiers require no special precautions for mounting as they produce no vibrations and have no bearings requiring alignment. Depending on the physical characteristics, they may be mounted on the ground or a platform and leveled up, or mounted on or suspended from any supporting member capable of supporting their dead weight.

Ventilation—As part of an electrochemical process the equipments, both motor-generator sets and rectifiers, may be required to operate in excessively humid or corrosive atmospheres. Whatever steps can be economically taken to reduce the effects of destructive atmospheres are well worth while.

The most desirable set up is to locate the generating equipment in a separate room (or location) into which the fumes cannot penetrate. The room should be located and proportioned so that a suitable quantity of clean fresh air is introduced into the room continuously and maintains an ambient temperature of 40 deg. C.

Where a separate room cannot reasonably be provided for the installation of the equipment, the equipment should be located in a position as far as possible from the presence of fumes. Also, proper clearance should be made around the equipment for maintenance and future dis-assembly. These comments apply equally well to both motor-generator sets and rectifiers.

Excitation—Where synchronous motor drives are employed, the excitation to the d.c. generator field should be removed so that the synchronous motor will be started under no-load conditions, and thereby permit acceleration with the least amount of line disturbance. It is essential that an ammeter be connected in the synchronous motor field circuit so that the motor can be operated under proper power factor conditions.

Field current on synchronous motors should be adjusted to the value indicated for best performance characteristics. If the field current is adjusted below normal, the motor will operate at a lagging power factor. If the current is adjusted above normal, the motor field windings will overheat.

Overload—Modern interpole generators perform efficiently at their rated capacity and with little maintenance. The amount of overload that the unit may produce, either in amperage, voltage or both is determined by the liberality of design and the degree to which the proceeding factors have been provided for. In general, overloads are accompanied by a loss in efficiency, increased brush costs and maintenance.

Rectifiers deliver their rated load efficiently and with very little maintenance. They are not suitable for applications which require overloading either in amperage or in voltage.

For overload protection, the overload relays in the primary circuit or those usually provided with the motor starting equipment are ordinarily sufficient. The overload protection may be a relay that will either disconnect the primary circuit to a rectifier or a driving motor, or remove the excitation from the generator and thereby remove the load. As a further form of protection against excessive current conditions, a current relay may be inserted in the generator line circuit. This relay will control contactor in the generator field circuit.

Care

To insure the best operation, make systematic inspection *at least once a week*, giving special attention to the following points:

1. Keep both interior and exterior of generating equipment free from water, oil and dirt.
2. Prevent excessive heating and wear of bearings by proper lubrication.
3. Check pigtails on brushes to determine that they are not loose.
4. See that brushes move freely in brushholders, and make firm, even contact with commutator.
5. Replace brushes with the same grade of brush recommended by generator manufacturer.
6. Keep commutator clean and smooth and maintain its polished surface.
7. Keep static pressure of clean air in room higher than room where fumes originate, so that air leakage is *out* of the generating room.
8. Provide suitable quantity of clean fresh air so that ambient (room) temperature does not exceed 40 deg. C. (104 deg. F.)
9. Avoid direct sun rays on commutators of generating equipment.
10. Remove foreign objects from bus distribution system.
11. Provide ample ventilation for and along distribution conductors.
12. Keep all bus joints tight.
13. Occasionally remove or blow dust from rectifiers.
14. Lubricate fan on rectifier once every 3,600 hours of use.
15. If heating occurs on any part of the generating equipment or distribution system, determine the cause immediately and correct it.

SIZE OF COPPER BUS BAR

for Low-Voltage Distribution in Electroplating Work

LOAD (Amperes)	NUMBER OF BARS	SIZE OF BARS (Inches)
250	1	¼ x 1
500	1	¼ x 2
750–1000	1	¼ x 3
1250–1500	1	¼ x 4
2000–2500	2	¼ x 4, each
3000–3500	3	¼ x 4, each
4000	4	¼ x 4, each
5000	5	¼ x 4, each

Length of run and voltage drop must be considered for each installation.

FEATURING

TYPE D HEAVY DUTY PUSH BUTTONS

No Rivets! All parts, including contacts, held by screws. Replacements and tightening made with a screwdriver.

Reversible Insulators! The two insulating pieces in each unit are interchangeable. They, also, are held together with screws.

Contact Flexibility! You can get two normally open and two normally closed insulated contacts on one unit without using flexible pigtails or similar devices.

Silver to silver contacts! For long life and trouble free service.

Protective Button Guard! Easily removed if not desired.

Eight unit lengths available in single housing if you like.

Large knockout holes! Especially desirable for wiring multi-unit stations.

Neat, rugged enclosures with flowing lines—think how many skinned knuckles that will save!

THESE "3C" TYPE D HEAVY DUTY PUSH BUTTONS are being supplied in many combinations, with Selector Switches, Pilot Lights, Mushroom Head Buttons, two mechanically interlocked units, and lock down device for single units. Flush mounted types are also available.

Contact our nearest office for full information on "3C" Bulletin 100 Type D Heavy Duty Push Buttons.

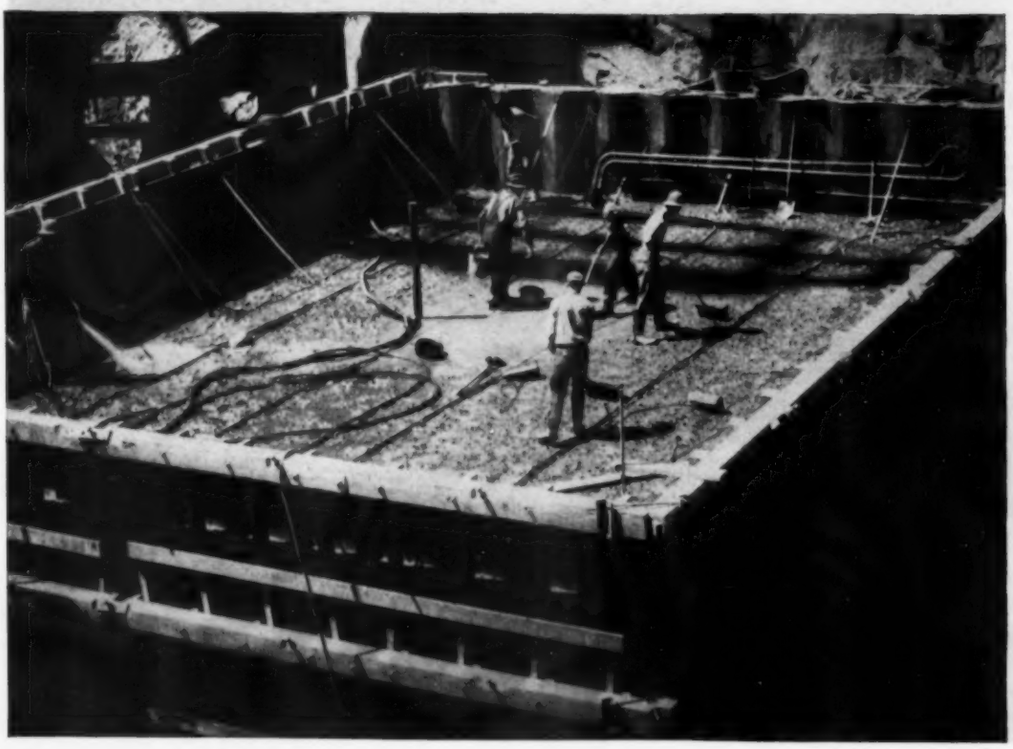
CONTINUE TO ROLL WITH CLARK CONTROL

THE CLARK CONTROLLER CO.

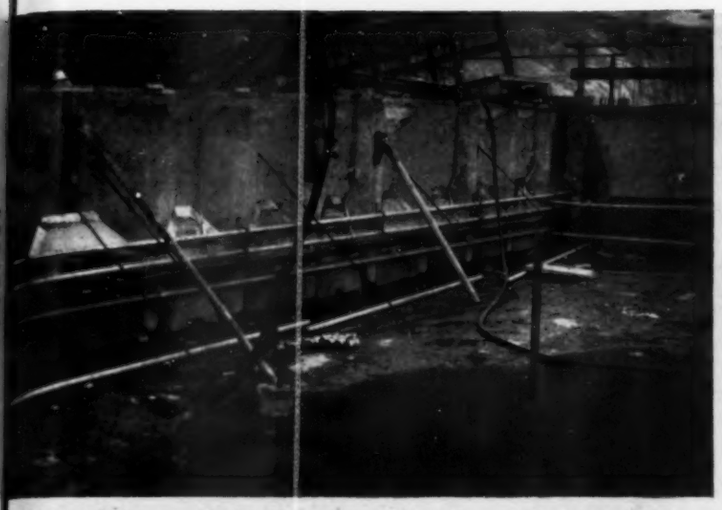
1146 EAST 152ND ST. CLEVELAND, OHIO

In building these massive dams, the concrete is poured in blocks up to 50 by 60 feet and 5 feet thick — one poured upon another to form a keyed-together columnar structure. To hasten cooling of the concrete and to prevent destructive shrinkage cracks, cold water is pumped through electrical metallic tubing placed between blocks. Approximately 1,048,000 feet of ELECTRUNITE Steeltubes in sizes ½-inch to 2-inch was used in Boulder Dam. This view of an 8-cubic yard bucket dumping a load of concrete on the tubing gives you some idea of the shock and strain imposed on Steeltubes.

STEEL
"Su



Approximately 1,774,800 feet of ELECTRUNITE Steeltubes in sizes ½-inch to 2-inch will be used in Grand Coulee Dam. In both dams, this tubing also was employed for filling in joint cracks formed between blocks by contraction of the concrete. The tubing was imbedded in each block near joints and cement grout was pumped through the system and into the joints under a pressure as high as 300 pounds per square inch. Tubing that withstands such tough service certainly is able to stand up on any wiring job in concrete slab construction. This photo shows a crew cleaning up a form preparatory to pouring the next block. The cooling tubing may be seen on top of the last pour, and a special arrangement of keyways and grouting tubing is visible on the rear form panel.



Materials used in constructing Boulder and Grand Coulee Dams had to be sound to insure safety for these gigantic structures—had to be strong and sturdy to resist the rough usage incident to fast-moving, heavy construction work. That ELECTRUNITE Steeltubes was selected adds to the evidence that it is sufficiently strong for all types of electrical work.

Part of the electrical metallic tubing used for cooling and grouting systems in Grand Coulee Dam. The use of compression-type fittings eliminated thread cutting, insured watertight joints and simplified installation, just as they do in installing electrical systems.

ELECTRUNITE STEELTUBES IN CONCRETE

"Stands the Gaff"

at Boulder and Grand Coulee Dams

• Is ELECTRUNITE Steeltubes suitable for concrete construction? Millions of feet of this electrical metallic tubing buried in tons and tons of concrete—employed on these huge construction jobs where structural abuse was much more severe than encountered on any wiring job—answer that question for you.

Look at the photographs—read the captions—and remember that the tubing used was the same product that is so widely used today as a sound, economical raceway for electrical wiring.

Use ELECTRUNITE Steeltubes for your next wiring job—whether exposed or in concrete—and learn how tough and strong it really is.

Steel and Tubes, *Inc.*

CLEVELAND • OHIO

SUBSIDIARY: REPUBLIC STEEL CORPORATION

UNDERWRITERS' LABORATORIES INSPECTED ELECTRUNITE REG. U.S. PAT. OFF. RIGID STEELTUBES-B PAT. NOS. 1588634, 1655306, 1962870 N-57 ELECTRICAL METALLIC TUBING

Look for this label—found only on genuine ELECTRUNITE Steeltubes.

Systems composed of electrical metallic tubing, compression-type fittings and shallow loom boxes were used for pressure grouting joints between blocks. The photo at the right show discs and tubing in position before pouring concrete.

Greenlee TOOLS

TIMESAVERS and PROFIT-MAKERS FOR THE CONTRACTOR

Conduit Benders

Greenlee Hydraulic Conduit and Pipe Benders are timesavers, because they bend faster than by other hand methods. In addition, they make smooth, even bends, making it easy to pull in wire and cable.

Knockout Tools

Greenlee Punches and Cutters make it easy to enlarge holes in switch boxes, cabinets, etc. They form clean-cut holes quickly and accurately, without reaming or filling.

Our new Catalog, No. 31E, illustrates and describes these tools, as well as many others of interest. If you do not have a copy, send for one now.

GREENLEE TOOL CO.
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Would like information on:.....

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My Jobber is.....EC6-39

Selecting Belts and Sheaves

When applying belt drives, remember that you cannot select them on the basis of motor horsepower alone. This also applies to any kind of mechanical power-transmission equipment. Select belts with sufficient capacity for the maximum load of the driven machines, with proper allowance for motor starting torque. When in doubt, it is far more economical to over belt than to under belt. A little excess capacity in belts more than pays for itself by increased life and reliable service, where an overloaded belt will be a source of trouble and expense.

This is emphasized by Table I for multiple V-belts, compiled from data originating in the engineering department of the Goodyear Tire & Rubber Co. On the basis of 10 belts being the normal required to drive the load, one additional belt will increase drive life 40 per cent where one less belt will decrease its life 35 per cent. In other words, spending 10 per cent more for belts gives a 40 per cent return on the whole investment, where spending 10 per cent less than normally required results in a 35 per cent loss on 90 per cent of normal investment.

Effect of sheave sizes on multiple-V-belt life is shown in Table II. Taking a 10-in. sheave as normal, a 11-in. sheave will give 65 per cent more belt life and a 9-in. sheave 41 per cent less belt life than with the 10-in. sheave. Of course these figures are based on operating the belt with correct tension for each of the three conditions.

What is shown in Tables I and II for multiple V-belts applies with equal force to flat belts. It brings home the fact that money spent to get the correct belt drive pays big dividends.

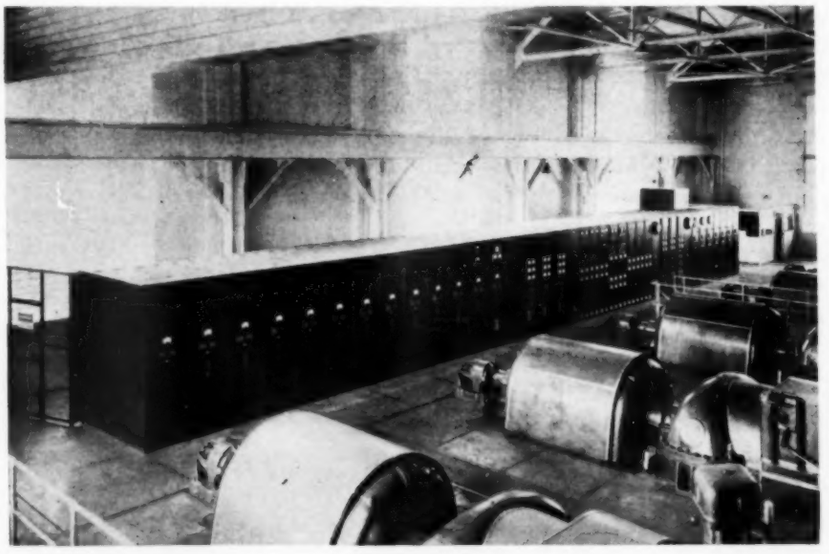
Follow motor manufacturers' pulley specifications whenever possible. Do not use minimum-diameter pulleys unless necessary, for they are for name-plate rating of the motor without overload. Every motor has a standard pulley size that will give a satisfactory drive. In many cases, it is economical to use a pulley larger than standard, but it is a safe rule never to use smaller ones unless drive requirements make it necessary.—*Extract from Power.*

Table I—Effects of Tension on the Life of Multiple V-Belts

Number of V-Belts	Percent Life
12	200%
11	140%
10 (Normal number of belts)	100%
9	65%
8	41%
7	23%
6	13%
5	6%

Table II—Effects of Sheave Diameter on the Life of Multiple V-Belts

Sheave Dia. (C Belts)	Percent Life
12 in.	260%
11 in.	165%
10 in. (Normal Sheave Diameter)	100%
9 in.	59%
8 in.	30%
7 in.	15%
6 in.	6%



MAINTENANCE SIMPLIFIED—*Metal-clad switchgear installed by a large rayon plant on its generator-room floor. Equipment consists of 38 units, controls three 2,400 volt, 2-phase, 60-cycle, and three 3,450-volt, 3-phase, 150-cycle generators with accessories and 20 feeders. All parts and connections are enclosed. Maintenance of circuit breakers, instruments and control mechanisms is simplified. When each unit is pulled out, it is disconnected from power service, and can be inspected, tested and serviced individually and safely. (General Electric Co. photo).*

Please, Keep Off— The Lighting Circuit

Numerous portable tools are designed for use on 110-volt circuits, or as advertised "can be operated from a lighting circuit." Lighting circuits are installed for lighting service and lamp sockets are designed to hold lamps. Portable tools will often overload the lighting circuit. Moreover, the extension cord is usually jerked out of the plug, thus putting a strain on the wires in the lamp socket and possibly injuring the insulation on the wires at the point of entry to the lamp socket.

Where portable tools are used frequently, it is advisable to put a polarized plug on the extension cord and run a special 110-volt circuit with outlets at convenient locations, maybe every 10 or 15 ft. Then too, with this arrangement the portable tool can be grounded.

More Space for Machines

When an envelope manufacturer in New England modernized the plant, many machines were refitted with new motor drives to save space, improve departmental interiors, and increase operating flexibility.

A universal rotary machine was formerly driven by a d.c. motor through a countershaft which occupied valuable space. The new arrangement substituted a 2-hp. variable speed motor bolted to the floor, and an adjustment between 290 and 295 r.p.m. is obtained by hand-wheel control. A short screened-in belt drives the main shaft on the machine. Speed can be adjusted to the requirements of the stock without loss of time to the operator.

This feature has proved valuable by enabling individually driven units to be kept up to "concert pitch" in production as internal plant conditions vary.

Flexibility for Small Melts

Ten to twelve different kinds of iron a day are made by the Carondelet Foundry Co., St. Louis, Mo. Also, the company has a list of over 60 mixtures for their customers' requirements. The set-up must be flexible enough to permit the economical production of small amounts of metal to fill orders quickly, and to meet all customers specifications.

After an electric arc furnace was installed Carondelet found that cast iron could be produced electrically with

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FROM STOCKS CONVENIENTLY LOCATED

JOHNSON

ELECTRIC MOTOR BEARINGS

Distributors Wanted

If you sell Electrical Supplies, investigate the profit possibilities in Johnson Electric Motor Bearings – No obligation.

● You can easily avoid costly delay when securing Electric Motor Bearings — if you order from Johnson Bronze. Complete stocks for more than 230 different motors — are always available in every principal industrial center. Johnson Electric Motor Bearings will give you better service when installed. They are correct in alloy, design and tolerance. Write today for our fully illustrated catalogue and the location of your nearest source of supply.

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TRY THIS SIMPLE METHOD AND SEE HOW YOU CAN SAVE TIME AND MONEY

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Make strong and neat connections easily

Gone are the days of complicated installation troubles with fussing over nuts to tighten—NOW, two squeezes on the handles of the B-M Inienter, and you have a connection that is strong and neat and at a fraction of the cost of older methods. Our method is patented and we limit the use of our tools to the installation of our fitting only.

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For Better Service—

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With the famous *powder-packed* element

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With genuine fibre tubes (not paper)

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Color tells the size

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Lock fuses and clips together

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For motors, line shafts, etc.

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STOP WASTED KILOWATTS AND WASTEFUL SHUTDOWNS

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for secure **Anchorage**
it's **PAINE**

For holding strength, for quick, easy installations, for *permanent*, trouble-free anchorage standardize on PAINE ANCHORS. These new re-engineered, redesigned anchors have holding strength far beyond the ordinary anchor — still cost no more.

Paine Steel Expansion Anchors

fasten anything securely in concrete, brick, tile, slate, marble and stone.

Having the largest gripping area of any expansion anchor, they hold firmly to the hole walls making them equally effective in bottomless or exact depth holes. Maybe used repeatedly with same security by bending jaws back to original position.

PAINE LEAD ANCHORS have added strength far beyond the ordinary anchor for actual tests have proven that their special lead-mix and improved construction has stepped-up holding strength as much as three times.

Strong, rigid, positively rustless, they are fully guaranteed for holding and lasting qualities.

These are the safest anchors for fragile materials, yet are equally effective in brick, stone, marble, etc. Their ease and simplicity of installation and permanent dependability save far more than the original cost.

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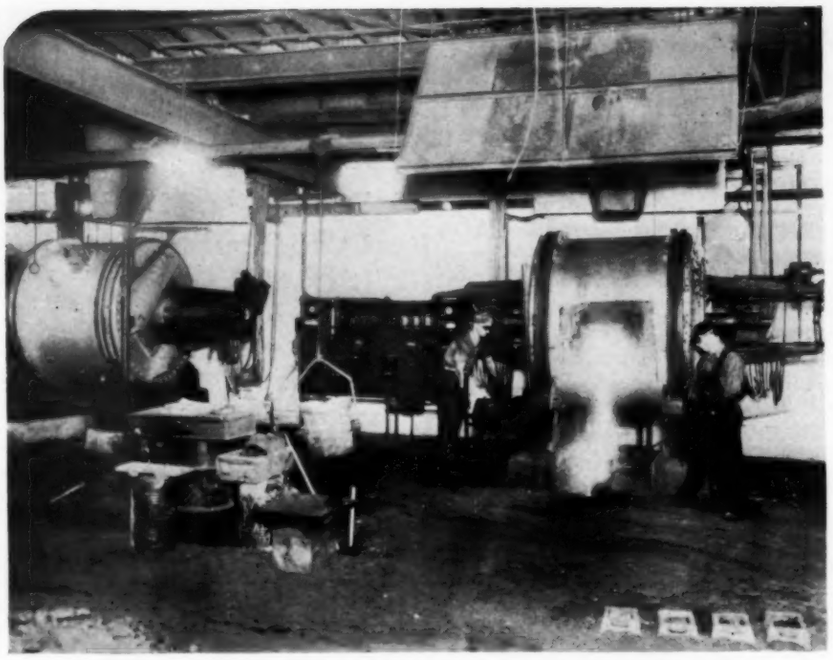
2961 Carroll Ave., Chicago, U.S.A.



EFFICIENCY *on small runs of different kinds of iron is made possible by electric arc furnaces at Carondelet Foundry Co., St. Louis, Mo.*

characteristics comparable to steel castings, steel forgings and malleable castings. A second furnace was installed approximately five years later. Both furnaces are the indirect rocking type, each with 3,000-lb. cold charge capacity and powered at 600 kw. Control of power input and of rocking action are automatic.

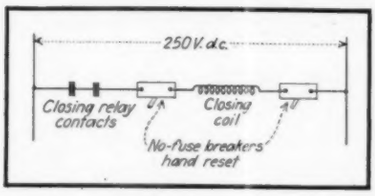
Protection Devised For Closing Coil

In a Midwest industrial plant, truck type oil circuit breakers are used as starting and running breakers for a group of synchronous motors driving some heavy rolls. Because of the very

INSPECTION AND COLOR SHADING—*This South Carolina mill has a reputation for producing the finest of cotton-rayon and spun rayon fabrics. This reputation is safeguarded by having inspection and shading carried out under "skylight" units. The illumination is produced by units having a combination of a 275-watt mercury-vapor tube and four 150-watt incandescent lamps above an angular channel of diffusing glass. These color-corrected lights are spaced on 12 x 16 ft. centers. Average light intensity at the working plane exceeds 30 foot-candles. (G. E. Vapor Lamp Co. photo.)*

severe operating conditions, slight mechanical troubles had developed in the operating mechanisms of these breakers. The troubles did not amount to much of themselves, but resulted in the solenoid-closing coil remaining energized and subsequently, in a short time, burning out.

Experiments were carried out with thermal cutouts on each side of the closing coil. It was found that although



SMALL BREAKERS protect closing coil from burnout.

these cutouts would very readily remove the coil from the line before it was damaged, lack of rupturing capacity caused the coil to burn up. While the coil drew 16 amp. at 250 volts, a cutout of from 8 to 10 amp. would carry the closing current and, in case the coil remained energized, would remove it from the line in 45 seconds.

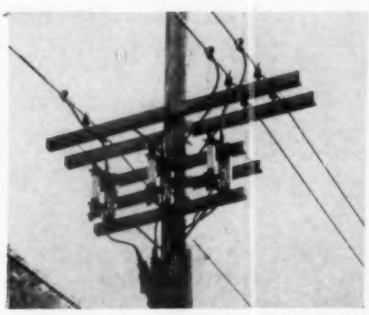
Tests with a commercial type of circuit breaker of the same capacity as the cutouts produced the same results, left the breaker in good condition, and thereby solved the problem.

Protecting 2200-Volt Industrial Circuits

By K. L. HOWE, *Industrial Engineer Westinghouse Electric & Manufacturing Company, Seattle, Washington*

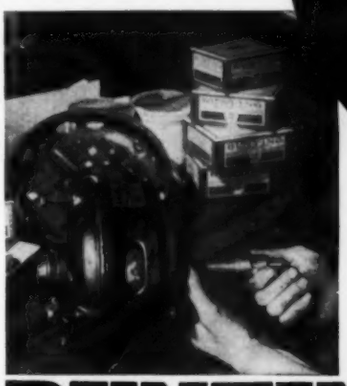
The requirements in circuit protection are definitely determined by the capacity of the source of power supply. The most serious lack of circuit protection usually exists on 2200-volt feeder systems, that radiate to different parts of a large industrial plant.

Feeders of such a system are likely to become subjected to extremely high instantaneous current values in cases of circuit faults. It is therefore neces-



OUTDOOR SERVICE—Here a 400-amp., 2300-volt paper mill main feeder is sectionalized out of doors.

Bunting makes it quick, easy and inexpensive to restore to duty any electric motor that needs new bearings.



● Write for catalog showing bearings for all makes of motors from 1/50 hp to 100 hp instantly available from stock . . . The Bunting Brass & Bronze Company, Toledo, Ohio. Warehouses in All Principal Cities.

BUNTING Bunting Quality

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PRECISION BRONZE BARS
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The Fastest Cutting, Longest Wearing Drill Ever Introduced!

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Drills Holes In Concrete, Tile, etc. 50 - 75% Faster!

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Stays Sharp Up To 50 Times Longer

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For All Rotary Electric Portable Drills

No more hammering! No more chiseling! No more slow, costly methods of hole drilling! The new Carboloy Masonry Drill drills holes in concrete, brick, tile, slate, etc., 50% to 75% faster! Lasts up to 50 times longer! Holds sharp cutting edge for weeks of continuous use. Drills holes accurate "to the hair." It's the perfect drill for installing expansion anchors quickly, cheaply and easily. Get the facts on this greatest time-saving, money-saving drill ever offered. Ask your dealer or pin cut below to your letterhead or postcard and mail today for free folder.

WRITE FOR FREE LEAFLET
Jobbers: **Get details on special resale proposition.**

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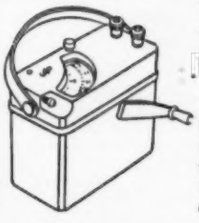
CARBOLOY COMPANY, INC.
11135 E. 8 Mile Ave., Detroit, Mich.

CARBOLOY MASONRY DRILLS

DO YOU WANT TO SAVE MONEY?

If so, make it a rule never to accept any new or repaired electric wiring or equipment unless it has been tested and the insulation found to be OK.



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OK MEGOHMER

—the lowest priced megohmmeter with its own self-contained D.C. generator.

SMALL in size—3¼x9x6 inches
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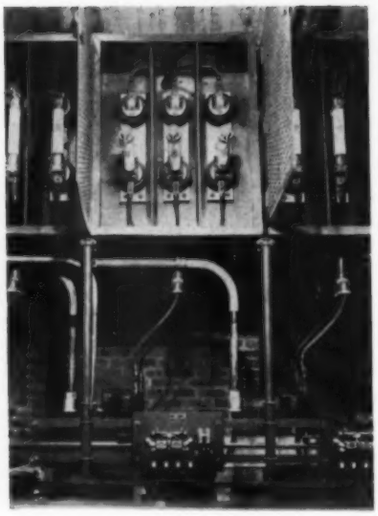


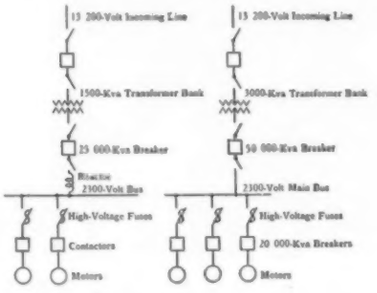
CONTROLLERS GUARDED — How 200-amp., 2300-volt fuses were installed ahead of oil-immersed motor controllers.

sary to fortify individual load centers, avoid system outages and prevent serious damage to motor control equipment of inadequate interrupting capacity.

A circuit fault occuring between the motor and its control should be cleared at the distribution center. Compromise breaker ratings, and delays in breaker tripping, rapidly magnify the damage being done to the motor control and cable circuit. The fault current and the many factors that determine its value, very often over-tax the breaker on the distribution circuit. The fault is then cleared at the main substation. The entire distribution center is immediately cut off from power supply. And power outage in unfaulted circuits is intolerable in many industries.

One economical solution to this problem is in the application of boric acid fuses. This fuse can be installed at all load centers in the place of disconnecting switches, since the fuse holder is hook operated. In the open position the entire fuse holder may be lifted by hand or by hook stick and removed for inspection. This dry type protector has an interrupting ability of 25,000 amps. in the 7500-volt, 200-amp rating. Refill cartridges can be carried in stock like any other electrical accessory.

In oil circuit breaker installations, there is a big step between values of current for interruption and current carrying capacity. The inverse time delay characteristic of the boric acid fuse permits customary devices to open the distribution center circuit breaker for modest values of overload current



TWO EXAMPLES—How boric acid high-voltage fuses fit into the protective scheme for medium and large—capacity motor circuits.

without fuse blowing. However, currents in the range of short circuit proportions will produce instantaneous operation. Where fuses are used, their high speed action results in a minimum in cable destruction and arc damage to low capacity motor control equipments. Many installations can be made safe by transferring the responsibility of circuit interruption under fault conditions to the fuse installed in the customary location disconnecting switches.

Since such fuse protection is good for circuits radiating from distribution centers, it can be similarly applied to many feeder circuits especially feeders to more than one distribution center. Both indoor and outdoor types have been applied to the improvement of circuits and apparatus protection.

Machines Taken to the Work

Often machines are easier taken to the work for certain operations than to transport work to machines. This is usually the case where a large or heavy object is difficult to move.

Portable electric tools and equipment with flexible shaft drives are increasing in use for this kind of service. Grinding, sanding, wire-brushing, and polishing tools for heavy castings are common examples.

Characteristics of Converters and Rectifiers

Several kinds of equipments are used to supply d.c. power when only a.c. power is available in the plant.

In the accompanying table "Operating Characteristics of Converters and Rectifiers," the maintenance man is provided with information on motor-generator sets, rotary converters and rectifiers. Data presented covers the range of ratings, efficiencies, regulation and life of the various equipments.

The table is a valuable supplement to the article "Batteries and Rectifiers, Types and Maintenance," which was published in the Maintenance Section of *Electrical Contracting,* May, 1939, page 37.

OPERATING CHARACTERISTICS OF CONVERTERS AND RECTIFIERS

(A.C. to D.C. Converting Equipment)

TYPE	RATINGS	EFFICIENCY	REGULATION	LIFE
Motor-Generator Sets	100 watts to 6,000 kw.	50% on small sets to 81% on larger sizes	Considerable range, depending whether generator is shunt or compound wound	Unlimited, if maintained properly
Rotary Converters	100 to 3,000 kw. at 250 volts d.c.	92 to 94%	4 to 6%	Unlimited, if maintained properly
Mercury Arc Rectifiers	100 to 3,000 kw. at 250 volts d.c.	87 to 93%	5 to 8%	Unlimited for vacuum pump type. One year for permanently sealed metal tube
Vacuum Tube Rectifiers	0.01 to 0.1 amp.; 250 to 1,500 volts d.c.	40 to 75% depending on operating voltage	20 to 50% depending on tube design, operating voltage and current	Average 3,000 hr.
Mercury Vapor Tube Rectifiers	0.05 to 25 amp.; 100 to 1,500 volts	40 to 88%	15% at low output voltage to 5% at higher votlages	Average 3,000 hr.
Argon Filled Tube Rectifiers	2, 5, 6 and 15 amp.; 6 to 90 volts d.c.	From 20% when charging one battery to 75% at full load	100% at low output voltage to 15% at maximum voltage	Average 3,000 hr.
Copper Oxide Rectifiers	*0.001 to 0.25 amp.; up to 4.5 volts single-phase; up to 5.5 volts on 3-phase, with natural cooling; up to 25 amp. at 6 volts with forced air cooling	40% for low capacity single-phase battery charger, to 75% for 3-phase fan-cooled rectifier	15 to 40% depending upon current density	Service experience indicates unlimited life
Copper Sulphide Rectifiers	*Up to 4 amp. with natural cooling; up to 35 amp. with fan-cooling; up to 2.5 volts d.c.	25 to 45%	10 to 25% depending upon current density	Field reports indicate 2 to 3 yr.
Silenium Rectifiers	*Up to 2 amp. with natural cooling; 8 to 12 volts d.c.	About same as equivalent copper oxide	About same as equivalent copper oxide	Unknown. Field experience lacking.

** Ratings apply to current and voltage of one disc. For higher voltages and currents, the proper number of discs are connected in series or parallel respectively.*

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TRADE MARK REG.

presents the

ULTRA-MODERN FLUORESCENT UNIT

for Commercial and Industrial Lighting

"Here is the answer to the Lighting Problems in our Plants".—So said an official of one of America's largest industrial organizations recently after seeing an installation of this new FLEX-O-LITE Unit.

The Unit is available in two models. Type HC-10 (shown above) delivers 85 foot candles at 30 inches, and consumes 150 watts. Type HC-12 uses two illuminating tubes, delivers 150 foot candles at 30 inches, and consumes 200 watts.

Outstanding Advantages

* Considered by many, to be the Nearest Approach to True Daylight yet produced. * Immediate Starting and Steady Light. * Life in Excess of 5,000 Hours. * Eliminates Sharp Shadows and Glare. * Not affected by Normal Temperature Changes.

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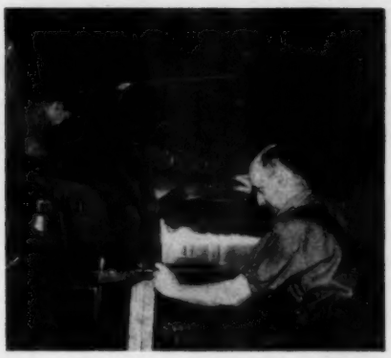
Motor Shops



COMMUTATOR LATHE attachments were bracketed to the machine frame for cutting a smooth surface.

WHEN YOU TEST VARNISH

Leading varnish manufacturers claim that the specific gravity of insulating varnish undergoes gradual changes due to the evaporation of solvents, and also because a mild "baking" effect takes place when hot stators or large coils are placed in the dipping vat. For this reason periodic specific gravity tests are recommended. Moreover, in doing special types of shop work a gravity different than standard value may be desired.

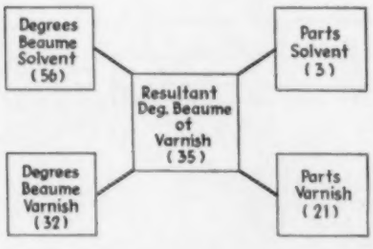
Varnish gravity is rated in Beaume (Be.) scale, which varies in different countries. The following conversion formulae apply in the United States:

$$\text{Deg. Be.} = \frac{140}{\text{Sp. Gravity}} - 130$$

$$\text{Sp. Gravity} = \frac{140}{130 + \text{Deg. Be.}}$$

When taking the gravity of varnish with an hydrometer note the varnish temperature. For temperature above 70 deg. F., subtract one degree Be. for each 10 deg. F.; when below 70 deg. F., add one degree Be. for each 10 deg. F.

A method for determining ratios of solvent and varnish to obtain a desired value is derived by applying the respective Beaume ratings of the unthinned varnish and the solvent that is being used. For example a varnish gravity of 35 deg. Beaume, is desired, using 32 deg, varnish base and a 56-deg. solvent. Here is the formula.


Degrees Beaume Solvent (56)
Parts Solvent (3)
Resultant Deg. Beaume of Varnish (35)
Degrees Beaume Varnish (32)
Parts Varnish (21)

In the above chart the solvent (56) — Desired Varnish (35) = 21, while the Desired Varnish (35) — Base Varnish (32) = 3. Thus 21 parts varnish and 3 parts solvent provide a mixture giving the desired consistency or gravity for the work in mind.

FIELD SETUP FOR A HEAVY TURNING JOB

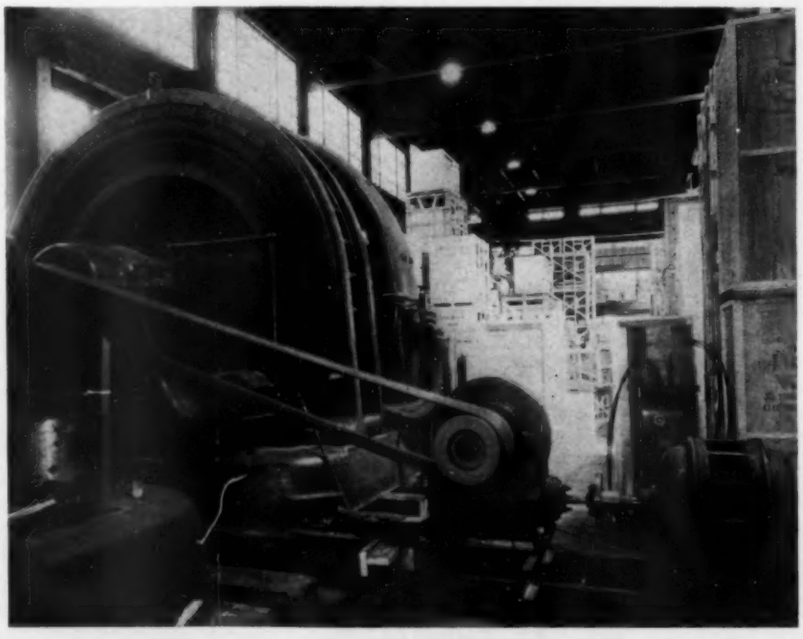
When three 1000 kva motor generators required their armatures turned before shipment from storage, the problem was to set up equipment for doing this work in the warehouse and thus save transporting these large machines to the shop. The armatures were reconditioned by the Stearns, Perry & Smith Company of Boston. Temporary driving equipment was set up which rotated these "dead" machines at about 70 r.p.m., while the armatures were being turned to proper smoothness.

For rotating the armature a 35 h.p. motor was direct-coupled to an elevator hoist unit. This equipment was mounted upon steel I-beams that formed a common base. The belt drive was applied to the extended shaft at the outboard end of the 1400 h.p., 6600 volt synchronous motor which drove each of these machines.

The 250-volt generator commutators were cut down to a smooth condition by setting up a temporary tool rest and bed plate next to the commutator surface. With this arrangement it was possible to recondition these three machines without extra handling or dismantling.

OVEN BUILT FOR CRAMPED QUARTERS

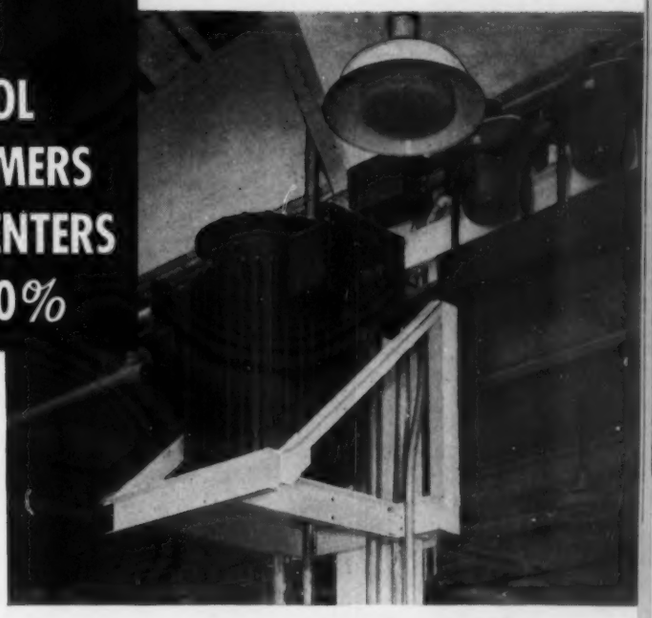
Aisle space was precious when a motor repair department was added to the Henderson Electric Shop in Jacksonville, Florida, so an interesting



SLOW SPEED drive provided for rotating large m-g set to recondition armature while machines are in storage.

Thinking of Improving Your *Lighting?*

G-E PYRANOL TRANSFORMERS AT LOAD CENTERS SAVED 40%



NOW you can modernize your lighting circuits—double and triple their capacity—*without installing new secondary copper*. This can mean *savings of up to 40 per cent*.

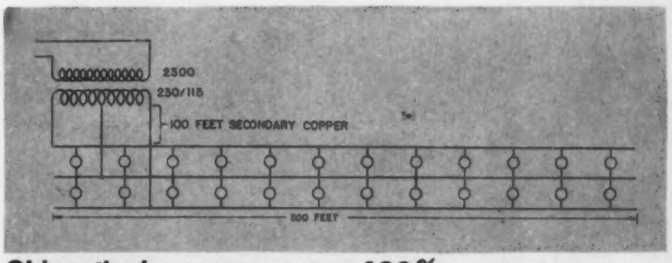
These savings are made possible by the use of Pyranol transformers, a G-E product which has been solving many other problems of power distribution in industrial plants. Because Pyranol, the liquid in these transformers, is noninflammable, they can be installed anywhere in the factory, even on beams up near the ceiling, without a fire-proof enclosing vault.

This means that you can divide existing lighting circuits into several sections, install a small Pyranol transformer at the center of each section, and modernize your lighting at much lower cost.

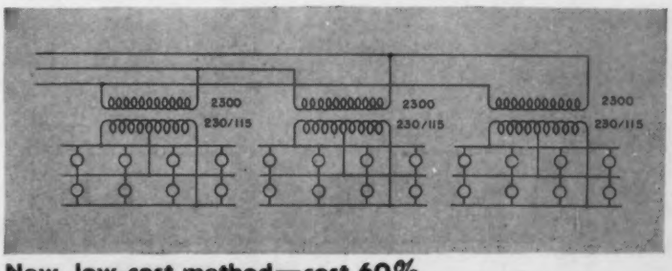
The diagrams on the right graphically depict the way this simple method was used in one industrial plant. Why not investigate it when relighting your next bay, floor, or building—and for new installations? We believe that the facts will lead you to specify Pyranol transformers. Ask your G-E representative for complete details, or write for Bulletin GEA-3180. Address General Electric, Dept. 6—201, Schenectady, New York.

←

To obtain the maximum benefit from modern illumination standards, the level of voltage supply at the lamps should be maintained precisely. One of our new AIRS air-cooled regulators on the secondary of each circuit will free the lighting circuits from voltage fluctuations due to changes in power loads supplied from the same source. These regulators are described in publication GEA-3057



Old method—assume cost as 100%
Complete new secondary copper, with a new transformer in substation outside building

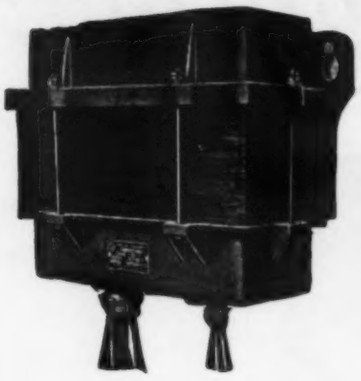


New, low-cost method—cost 60%
Use the existing secondary wiring, dividing it into several sections. Install a new primary feeder, and a small Pyranol transformer in the center of each section

GENERAL ELECTRIC

300-73

MERIT



Below: Type CF, Single-phase, outdoor-type, air-cooled, general - purpose transformer.

Above: Type CFT, three-phase, outdoor-type, air-cooled, general-purpose transformer.

Whenever it is desired to obtain a low-voltage supply from a higher voltage circuit you will find AmerTran Type "CF" Air-Cooled Transformers both economical and convenient to use. These moderately priced units may be installed wherever they are needed—either outdoors or indoors*—without the necessity of oil, fire-proof vaults or enclosures. All sizes are equipped with either conduit fittings or a built-in junction box to facilitate installation, and both single-phase and polyphase types are furnished as a single unit. Available in capacities up to 100 Kva. and for potentials up to 2400 volts, all ratings offer low initial investment, minimum installation and maintenance expense, and low operating cost. Let us send data on equipment to meet your needs. Ask for bulletin 1116A.

* Units rated 15 Kva. and larger for indoor service only.

Type "CF" Applications

1. Stepping down power circuit voltage to 115/230 volts for lights, small motors or heating elements. In this way advantage may be taken of lower power rates for low-voltage loads.
2. Obtaining a 3-wire circuit from a 2-wire system.
3. Changing from 3 phase to 2 phase, or vice versa, on a power sytsem.
4. Obtaining low voltage for heating, welding, 32-volt tools, special lighting, testing, etc.
5. Balancing load on 3-phase systems.
6. Insulating one circuit from another.
7. Distributing power at 600 volts or less.
8. Reducing light flicker.
9. Obtaining special voltages to permit efficient operation of equipment.

AMERICAN TRANSFORMER COMPANY

178 Emmet St. Newark, N. J.

PRODUCTS

American Transformer Co. manufactures transformers for every industrial, electronic and laboratory application in sizes up to 10,000 Kva and for potentials up to 132 Kv. Other products: voltage regulators, test sets, rectifiers.

AMERTRAN TRANSFORMERS

Manufactured Since 1901 at Newark, N. J.

Motor Shops

[FROM PAGE 56]

space-saving design was worked out for its electrically heated bake oven. Made of cellular sheet steel panels, the front has a counter-balanced vertical-sliding door that is five feet high and four feet wide. When opened this sliding door provides access to the oven's entire width and its 3-ft. depth without taking up extra aisle space.

A 24-in. by 10-in. gravity-drop hinged safety door was placed in the main sliding door to relieve any internal stresses from taking place in case of an accidental explosion of varnish fumes. A 1-in. hollow space between outer and inner panel sheets is packed with rockwool insulation.

A hinged vertical section divides this oven into 3 ft. and 2 ft. compartments,

SPACE SAVER—*Sheet steel oven has vertical sliding door to conserve aisle space for this southern shop.*

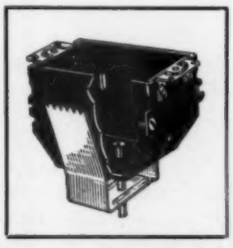
the smaller left part having shelves made of pipe framework for stacking in small armatures and stators. When large apparatus requires all the oven space, the dividing section may be swung back against the oven's rear wall.

Two time-controlled 2-kw., 220-volt range elements are employed, which generate a temperature of 315 deg. F. in one hour and 15 minutes. The vertical door is counter-balanced for easy raising with a 3-in, lead-filled conduit weighing 242 pounds, fitted at the ends with roller bearings to slide easily upon 1¼-in. angle iron standing rails. The conduit counterweight is attached to the 242-pound door by means of stranded steel cables which pass through grooved overhead idler pulleys. The approximate cost of building this oven was $260.

NEW JOBS—RURAL and URBAN MODERNIZATION—are more profitable when RACO • ALL-STEEL • PRODUCTS are used

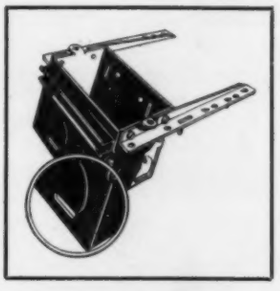
• Wherever there are wiring jobs Raco•All-Steel•Products can be used advantageously. Wiring of new structures demands the use of modern devices. Profitable remodeling-wiring calls for items that can be installed easily, quickly.

Developed by competent engineers who keep pace with modern wiring trends, Raco • All-Steel • Products offer numerous improvements which are of importance to everyone in the building and electrical industries—for example:



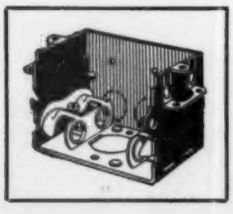
RACO • ALL-STEEL OLD WORK SWITCH BOX

The maximum of convenience and utility for mounting in a re-wiring or modernization job.



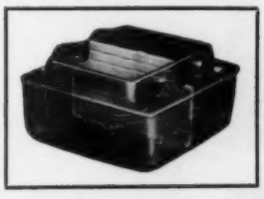
RACO • ALL-STEEL "PRI-OUTS"

Clamp Boxes, in both the Switch Box and Outlet Box lines, are equipped with "Pri-Out Knockouts.



RACO • ALL-STEEL SWITCH BOXES

The MC, used in old or new work, is illustrated. The Switch Box you need is in the Raco • All-Steel Line

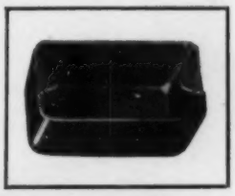


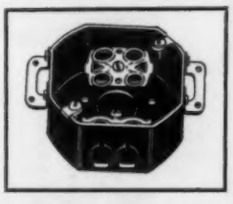
RACO • ALL-STEEL "HI-LO" BARRIERS

Barriers for the separation of differing voltages, may be used with Standard Raco • All-Steel Square Cornered Switch Boxes, in 2" and 2½" depths—or with Raco • All-Steel 4" Square Outlet Boxes and Covers. No necessity of carrying special items in stock.

RACO • ALL-STEEL UTILITY OR HANDY BOXES

Most convenient for surface wiring—old or new work. The line includes several depths and all appropriate covers.





RACO • ALL-STEEL EXTERNAL MOUNTING EARS

For Outlet Boxes. Any type of Raco • All-Steel Octagon Box will be furnished equipped with External Mounting Ears on Special order. A real labor saver.

And there are many other Raco • All-Steel features of importance to you—write for catalog illustrating this outstanding line, which is backed by a total of more than 40 years of experience—there is no obligation.

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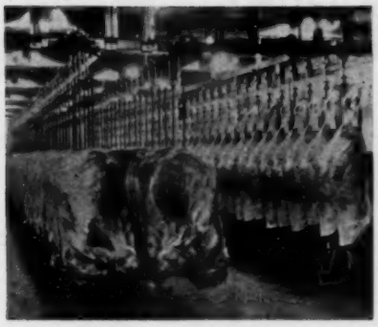
SWITCH BOXES • OUTLET BOXES • CUTOUT BOXES
CABINETS • FUSE CABS • CONDUIT FITTINGS

Better Lighting



COOL LIGHT—*Stack lights set high to illuminate a modern beef cooler in a Rochester plant.*

ENGINE HOUSE LIGHTING

Servicing locomotives has been made easier in an eastern enginehouse by an installation of 54 Westinghouse lighting units, designed to withstand corrosive atmospheres. They consist of chromium plated copper reflectors, coated on the outside with acid-resisting enamel. Heat resisting glass lenses seal against dust and moisture.

OLD STYLE LIGHTING *showing how steam and smoke cause a halo around the suspended light. New installation shows how light is evenly distributed over the floor and the sides of the locomotive.*

The 300 and 500 watt reflectors were installed to direct light from an angle at a height of 16 ft. above the floor. Two fixtures were mounted on each inverted T conduit bracket and arranged so as to throw light on engines in adjacent stalls. Three or four fixtures, depending upon the size of the stalls, light each locomotive. At the front of the stall, above the locomotive tender, light from the same type unit is directed through a spread lens, illuminating one side of two tenders in adjacent stalls.

The lighting circuits have been flexibly arranged so that any part of the locomotive, the men happen to be working on, may be illuminated. The circuits are controlled from circuit breaker switches at the rear of the stalls.

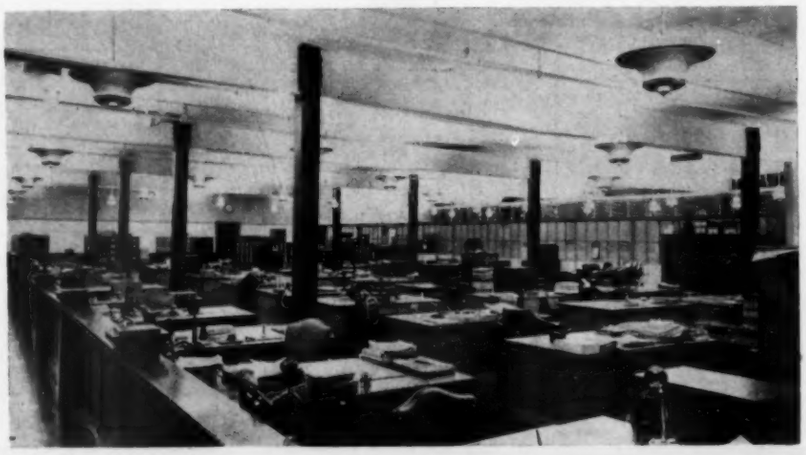
LIGHTING A BEEF COOLER

Excellent lighting is provided in this beef cooler room of the Rochester Packing Company, in Rochester, New York, by a system of stack lighting units equipped with 100-watt lamps. The units are 3 feet apart and on a staggered arrangement. The illumination on the vertical is 40 footcandles at the top and 20 footcandles at the bottom. Lamps are located as high as possible, since if they are placed very near the meat, the local heat from the lamps may spoil the meat.

A frequent question in the lighting of refrigeration rooms, is the relative heating effect of vacuum vs gas-filled lamps. The fact that the gas-filled lamps appear hotter gives rise to the erroneous assumption that gas-filled lamps will heat the interior more than vacuum lamps of equal aggregate wattage. Vacuum and gas-filled lamps of equal aggregate wattage emit equal total amounts of energy as heat, hence their effect on the cooling system is the same.

RE-LIGHTING FOR AUTO SALES

An outstanding example of modern lighting applied to a modernized automobile show room is that of the Central Chevrolet Corporation in Rochester, N. Y. Here the cooperation of lighting engineer, tenant and building owner devised a desirable exterior treatment, clear merchandise displays for the passerby, and good interior lighting for a showroom that is 70 feet square. Using a total connected load of



***BLENDED INDIRECT**—Combined mercury and mazda in these Guth Mer-Co.-Lux units provides 20 f.c. for the Fairmount (Minn.) Railway Motors Co. Units are on 12 ft. centers with 250 and 500 watt lamps in each. Light brown acoustical ceilings are to be lightened to increase intensity to about 30 f.c. The Fairmont Electric Co., also installed sixteen units in the drafting room on 8-ft. centers for 12-ft. ceilings.*

no "free" service calls

when you install a Sangamo Time-Switch

To assure quiet, smooth-running motors in Sangamo Time-Switches, a sensitive stethoscope is used to check every single motor. This test is part of an intense inspection routine which has but one purpose: To make certain that, once installed, no "free" service calls will curtail your profit on a Sangamo Time-Switch.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD · ILLINOIS

KAZ Time-Switch

Many a store owner hasn't a time-switch for his display window or sign. A Sangamo Form KAZ Time-Switch with Astronomic Dial will remedy this situation, conveniently, completely . . . and profitably for you!

WIREMOLD *opens* FACTORY DOORS
FOR ALERT ELECTRICAL CONTRACTORS

Use the help that Wiremold can give you in going after profitable industrial business. With "Pancake", the Wiremold Overfloor Wiring System, you can sell a real production-cost cutting service to manufacturers.

Photograph shows installation of Wiremold Overfloor Wiring System in a factory.

Show them how this easily installed modern wiring brings current to work where they want it, quickly, economically and without costly alterations.

Showing Plugmold installation bringing convenient electrical outlets for easy accessibility to bench equipment.

Show them how Plugmold, The Wiremold Multi-Outlet Assembly makes outlets accessible for portable lights or small motor driven equipment on benches and inspection racks.

Show them how the New Wiremold Fluorescent Lighting Strip brings BETTER LIGHT . . . "PLUS" LIGHT to many exacting seeing tasks.

Reach out for this profitable business and take advantage of the help that Wiremold Engineers can give you in securing it.

Here are Wiremold data sheets showing industrial applications of The Wiremold System — Take advantage of this help in your selling.

ADEQUATE WIRING SERVES AND SAVES

WIREMOLD *Your* BUSINESS BUILDER

THE WIREMOLD COMPANY · HARTFORD, CONN.

[FROM PAGE 60]

40 kw., in the showroom, with wiring for 9 future 1500 watt units, there is ample capacity to maintain 35 foot-candles generally, and 80 foot-candles along the window display area.

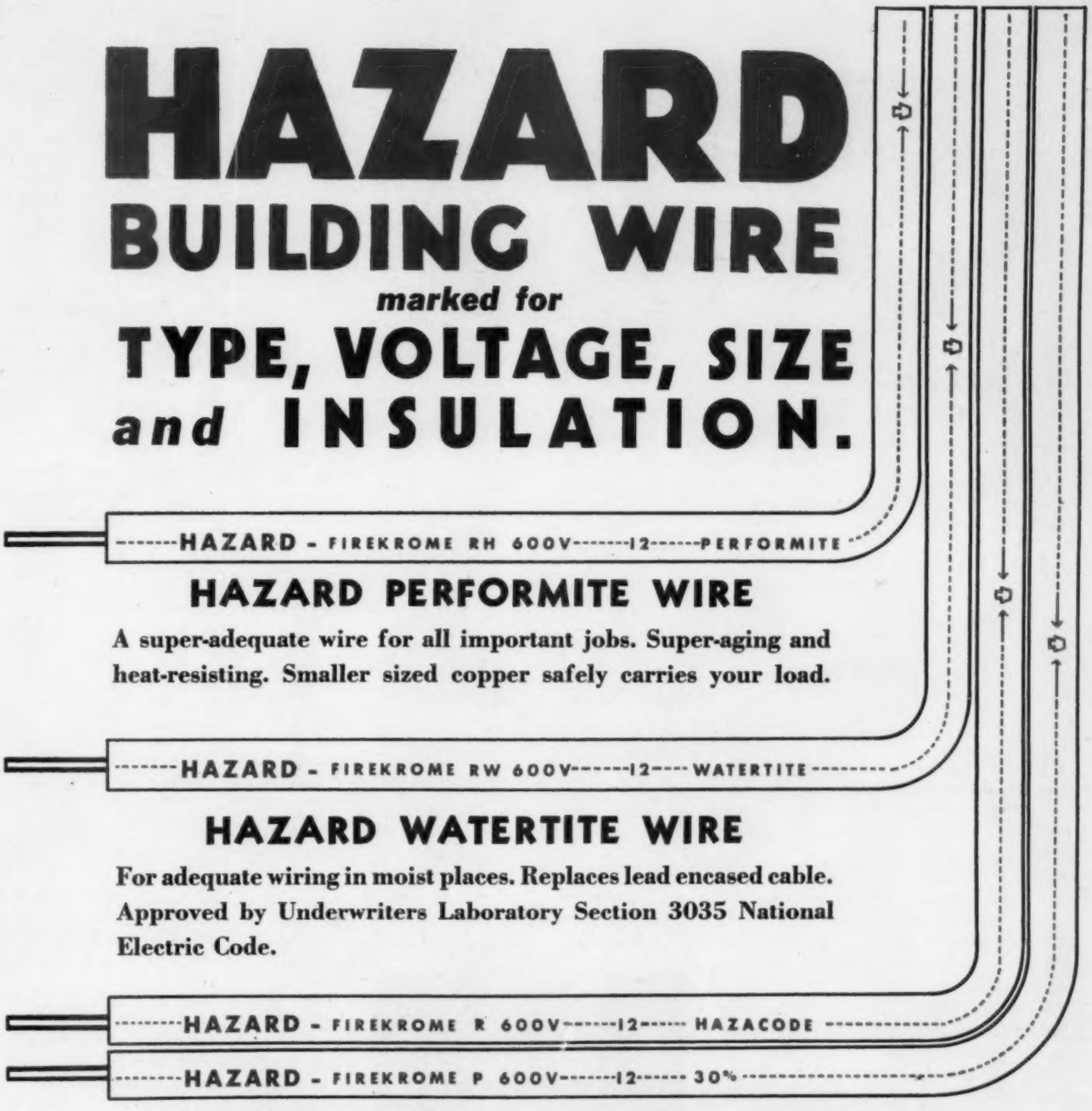
The unusually high foreground illumination is derived from seven 1500-watt recessed, ceiling-louvered reflectors. These are supplemented by 500-watt spotlights for featuring certain displays. For general lighting, there are four pendant luminaires in the 30-ft. ceiling area, each unit having six 750-watt lamps for indirect, and six 150-watt lamps for direct lighting. Areas above and below the balcony have indirect, bowl-silvered units. The 750-watt size is employed on the balcony and the 500-watt below. These, and the recessed ceiling units were furnished by Curtis Lighting, Inc.

The exterior, with its large area and unique pattern of plate glass has been given an added decorative touch by the luminous clock face, and several electric discharge signs.

DISTINCTIVE MODERNIZATION —Auto showroom planned to attract passerby and capitalize feature displays.

COMPLETE TREATMENT — High foreground illumination for window shoppers balanced with adequate general interior treatment.

HAZARD
BUILDING WIRE
marked for
TYPE, VOLTAGE, SIZE *and* INSULATION.


HAZARD - FIREKROME RH 600V 12 PERFORMITE
HAZARD - FIREKROME RW 600V 12 WATERTITE
HAZARD - FIREKROME R 600V 12 HAZACODE
HAZARD - FIREKROME P 600V 12 30%

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A super-adequate wire for all important jobs. Super-aging and heat-resisting. Smaller sized copper safely carries your load.

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For adequate wiring in moist places. Replaces lead encased cable. Approved by Underwriters Laboratory Section 3035 National Electric Code.

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HAZARD 30% (Performance Grade) and HAZACODE (Code Grade) Adequate Wire for all standard service jobs. Imprinted every 2 feet. Six standard colors. Meets requirements of the National Electric Code Standard.

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DIVISION OF THE OKONITE CO.
WORKS: WILKES-BARRE, PENNSYLVANIA

New York Chicago Philadelphia Atlanta Pittsburgh Buffalo Boston Detroit
Seattle Dallas Washington San Francisco St. Louis Los Angeles

Questions ON THE Code

Answered by
F. N. M. SQUIRES
Chief Inspector New York Board of Fire Underwriters

Motor on Branch Circuit

Q. *"Could a 1 hp. single phase 110 volt motor with a full load of 11 amps. be connected to a 15 amp. branch circuit supplying lights? Table 10 states a No. 14 could be used as the branch circuit fused at 35 amp. and 4322 (b) states that no running protection is needed."*—F. R. B.

A. Assuming this to be a fixed motor the answer is No. Section 2125 limits the size of a motor on a branch lighting circuit to 6 amps. Also the fuse would be limited to 15 amps.

However, if the lights were in heavy duty lampholders, then such a motor could be used on a 20 amp. branch circuit or on a 25 amp. branch circuit. In the above cases, fuses of proper type ("time-lag") would probably have to be used.

It should be kept in mind that both Table 10 and rule 4322b (mentioned in the question) deal with motors and motor circuits and not with combination motor and lighting circuits. If the lights were removed from the circuit, then the layout would be all right, providing the motor was at all times within sight of the operator when in use.

Farm Wiring Methods

Q. *"What kind of wiring must a person use in a barn-chicken house where hay is stored in the loft? Also where you run through a grain bin located in the same barn?"*—L. H. C.

A. While some persons have claimed that barns are dusty places and therefore should be classed as a Class 2 Group G location, it was not the intent of the Code to so classify a barn. Therefore any approved method of wiring can be employed.

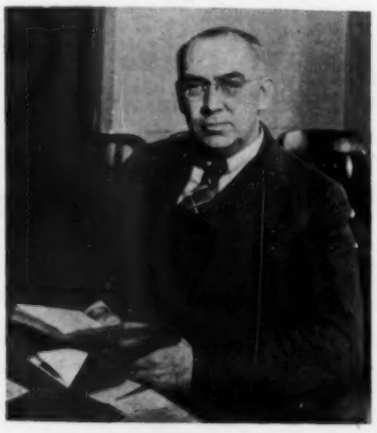
Of course, conduit or electrical metallic tubing is to be recommended in locations where the wiring may be subject to mechanical injury such as from the loading or unloading of hay. Otherwise, other types of wiring such as armored cable, or non-metallic sheathed cable, can be employed.

Bakelite Screws for Bathrooms

Q. *"What about bakelite top screws in plates for bathroom use?"*—N. K. McA.

A. This is covered in section 3706b which specifies—"Non-metallic covers and plates shall be used with non-metallic outlet boxes, except that a metal cover or plate may be used if covered on the exposed side with non-metallic material. Screws shall not be used for fastening such covers or plates to non-metallic boxes unless located in such a position that they cannot come in contact with live parts or live conductors in the box, or *unless the exposed screw heads are covered with non-metallic material.*"

The rule should have said ". . . non-metallic and non-combustible material" so as to definitely prohibit celluloid covered switch and receptacle covers.

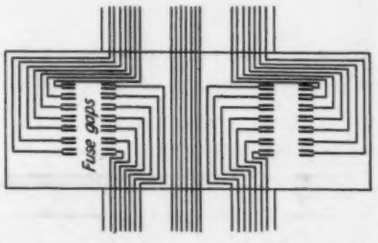


DISTRICT CHIEF—*J. S. Zebley, has been chief electrical inspector in the District of Columbia since 1932. A staff of 26 people, in the inspection department, looks after all electrical work in the District excepting that done in government owned buildings at the nation's capitol. About 5000 structures of a public nature are required to be reinspected annually. Mr. Zebley is a former president of the Eastern Section, International Association of Electrical Inspectors.*

Built-up Panels

Q. *"We are prohibited locally from building up our own fuse boxes. However, we are allowed to build gutters, providing they do not contain fuses. I am unable to find any section in the 1937 Code, which would prevent a fuse cabinet from being constructed from approved parts.*

"The assembly I have in mind is one as shown in the following sketch. It



often would be convenient to install a cabinet or box housing a number of fuses. Will you kindly advise whether or not the 1937 National Electrical Code prohibits such installations?"—I. N.

A. Undoubtedly such a panel should be provided with gutters, which in this case would be center, side, top and bottom wiring spaces.

Probably many inspection bureaus would require that the whole assembly bear an Underwriters' Laboratories' "Enclosed Panelboard" label. In this case suitable gutters or wiring spaces would be provided. We must, however, bear in mind that the Laboratories also label cabinets and list approved cutout bases which a contractor may himself assemble into an enclosed panelboard. If the component parts of such an assembly are properly selected, proper wiring spaces and gutters provided, and proper spacing maintained, there is no reason why the assembly should not be acceptable to the inspection authority. The 1937 Code references are as follows:

103705, refers to the material of the cabinets and compliance would be insured by the use of a labeled box,

103706, requires definite spacing and wiring spaces,

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Made from a steel developed for this work alone, the conduit has a ductility which is uniform throughout each length. Work with a hickey is fast and quick. Your workmen can make real time when the conduit bends on comparable radii with the same flexibility and there's no back lash in the pipe. Threads, cut once, are clean, need no chasing.

Buckeye Conduit is lined with satin-smooth lacquer lining, flexible but tough. Fish wires won't scratch through, and when you push cable on short runs, there will be no cracked lining to fight.

Speed on a job means profit, and Youngstown Buckeye Conduit is the first step to making time and saving money on any installation.

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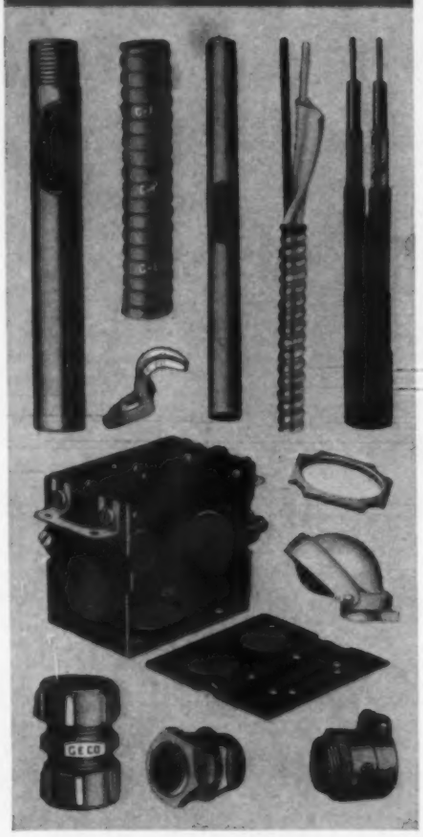


For information about G-E White Rigid Conduit, G-E Flexible Conduit, G-E Electrical Metallic Tubing, G-E Blue-bushed BX Armored Cable, G-E BraidX or Boxes and Fittings, see the nearest G-E Merchandise Distributor or write to Section C-946, Appliance and Merchandise Department, General Electric Company, Bridgeport, Conn.

See the G-E "House of Magic" at New York and San Francisco

GENERAL ELECTRIC

Questions on the Code

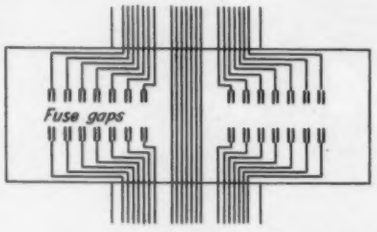
[FROM PAGE 64]

103845, requires approved parts for the assembly,

103848, requires proper spacing for live parts,

3881, puts a definite limit on the number of fuses permitted in a cabinet.

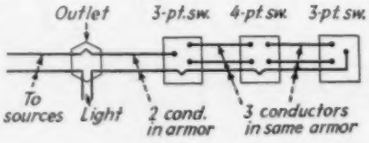
But there is one matter to which it would be well to give consideration although there is no Code ruling on it at present. The next Code may have. In the first sketch the fuses are arranged in vertical tiers.



This sort of arrangement, especially with large sized fuses, tends to decidedly derate the upper fuses. A better arrangement would be to arrange the fuses in a horizontal row so that the heat from the lower fuses would not by convection, affect the upper fuses.

Three and Four Way Switches

Q. *"Does wiring according to the following drawing violate section 3802?"*—F. M. McE.



A. The above sketch shows the proper and required way of wiring for the three and four point switches. The black or colored wire, which is the hot or underground wire of the circuit, is carried to and through the switches, which is proper according to the first sentence of Section 3802.

Then by the use of three conductors in cable armor or conduit, the second sentence of 3802 is complied with. This also complies with Section 3052.

A Rural Hookup

Q. *"I am enclosing a diagram for which I would like to have you check for proper fusing, and if this installation comes within the Code?*

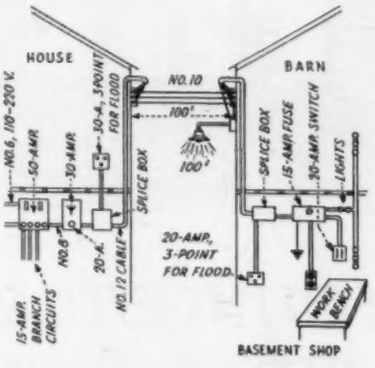
I might mention that the floodlight might be on the house or on a pole between the span, and that in some cases the direct earth cable will be used instead of an overhead system.

I also would like to know where the switch should be located for the mains beyond the floodlight, when the tap is made at the house side of 15 amp. circuit, instead of as shown in diagram?" —G. C. P.

A. The hookup as shown in sketch No. 1 would not be correct unless the total load in the barn plus the floodlight would not overload a 15 amp. branch circuit. With the fusing of the circuit (at the 30 amp. switch in the basement of the house) with 15 amp. fuses this arrangement could be used. The size of wires need not be as shown in the sketch although wires larger than No. 14 are desirable to reduce drop in voltage.

What is wrong with the arrangement as shown is that the line running to the barn is indicated as a feed and the floodlight is connected to this feed instead of to a branch circuit as required by the Code.

The diagram indicates that there are eight light outlets and one duplex receptable in the barn besides the 100-



watt floodlight. In accordance with paragraph b of section 2107, these ten outlets would figure as 1½ amp. each, giving a total of 15 amp. which could all be placed on a 15 amp. branch.

If the wires are carried underground between the house and barn the grounding of the neutral wire in the barn should be eliminated.

In case the load in the barn is too great for a single 15 amp. branch circuit the three wires shown in the sketch could be used for the floodlight (No. 14 wires would be sufficient) under the protection of a 15 amp. fuse and a separate feed line could be run between the 30 amp. switch in the basement to the cutout in the barn.

Or, as the service to the house is indicated as 3-wire, 110/220 volts, another wire could be added to those shown, making four wires running between the house and the barn. This would provide a 3-wire 15 amp. branch circuit.

New . . smaller size
TRUMBULL "125" FLEX-A-POWER
opens wide new field for Contractors

- ECONOMY . . . in installation cost and maintenance, even on short runs of 10 ft. or more.
- SALVABILITY . . . Relocated or re-installed in any location. No parts can deteriorate.
- FLEXIBILITY . . . meets every requirement of relocating machinery or extending system.
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- EASY INSTALLATION . . . simple construction, small size, light weight.
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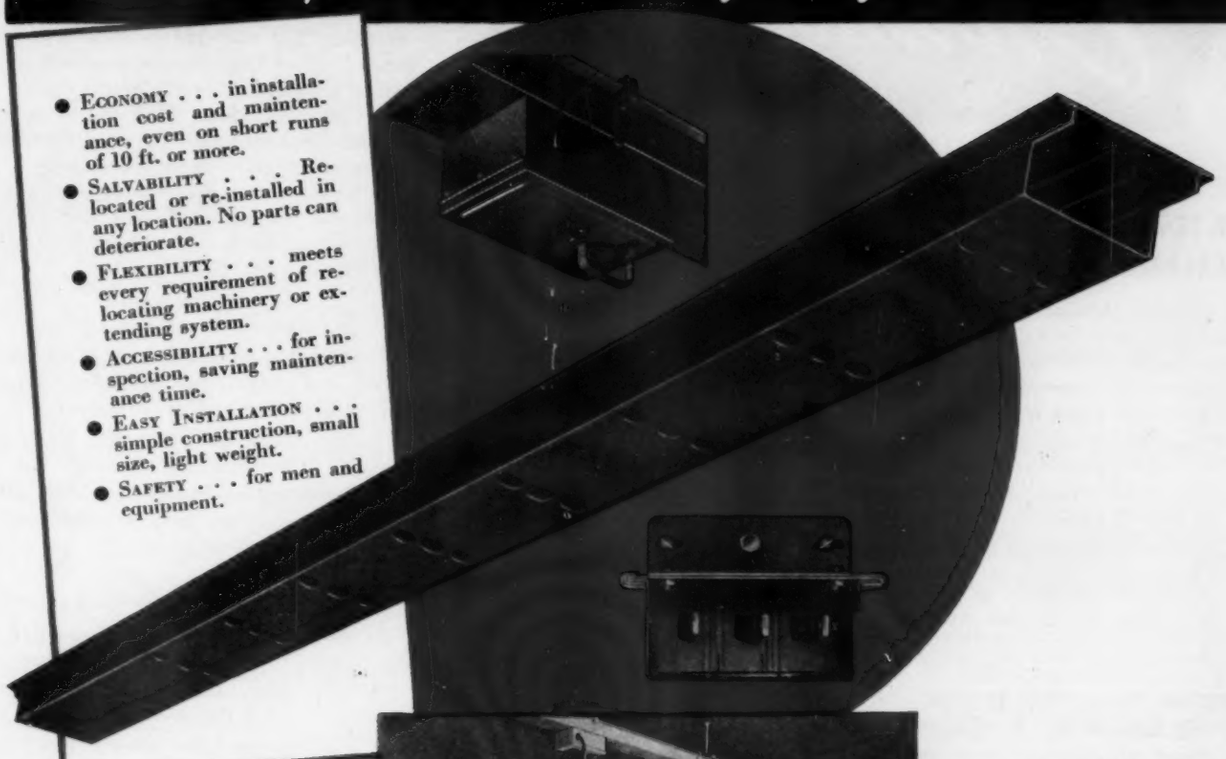
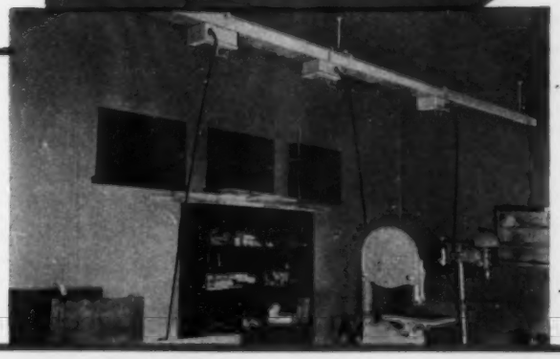


Photographs above show a standard 10 ft. length of "125" Flex-A-Power and a cross section view showing the rugged construction. The upper photograph shows method of plugging in with Flex-A-Plugs.



Illustrated is a typical installation of "125" Flex-A-Power serving a group of machines in a small manufacturing shop. Note compact, small size and clean simplicity of the installation. Machines can be moved or additions made merely by plugging in.

Up to now, modern, low-maintenance, high-efficiency feeder distribution systems have been confined to the larger industrial plants served by Buss-Wa and Flex-A-Power. But with the introduction of the NEW small-size, light-weight, low-cost "125" Flex-A-Power this whole picture changes.

Here is a real Trumbull Feeder Distribution System, complete with all fittings and Flex-A-Plugs that plug in on 12″ centers, built to the same rigid specifications as the larger Trumbull Systems, yet so compact, inexpensive and easily installed that every garage, workshop or small industrial plant in your territory becomes a live prospect. "125" Flex-A-Power can be installed even in runs as short as 10 feet, easily placed in position as required on regular hangers provided with each length. Simply buy as many lengths as may be needed, complete with fittings, hang in place and the job is finished.

Here is a real opportunity for immediate profitable business, opening up entirely NEW fields for the electrical contractor. Get in touch with a Trumbull Representative or your Wholesaler. Circular No. 316 sent on request.

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Right ON THE JOB

PRODUCTS THAT ARE RIGHT FOR THE JOB . . . SERVICE THROUGH WHOLESALERS AND CONTRACTORS WHO ARE RIGHT ON THE JOB

Estimating

HIGH TENSION UNDERGROUND SERVICE

A primary service running underground from pole to manhole to building on a large auditorium building gave us a quantity of interesting installation data. The time study was broken down to easily separated sections of the job and the following analysis made.

1. *Fiber conduit*—Two lines each 550 feet long laid parallel from pole to manhole and manhole to building. Trenching, backfill, manhole and concrete envelope subcontracted to a general contractor. The trench was filled to specified depth with concrete and ducts then laid on top with joints grouted over. Balance of concrete envelope was then poured over all. This proved a very rapid method of installation.

Total time laying duct—40.75 hours
Average time per 100 ft.—3.70 m.h.

2. *Conduit up pole*—Operation included bending two pieces of 4-inch conduit in 90 deg. long radius bends. One was reduced to 3 inch and run up the pole 40 ft. with an offset. The other was capped at pole base.

Total job time—22 m.h.
Average time per ft. of pipe—.383 m.h.

3. *Painting conduit*—Used 1 quart aluminum outside paint which covers well with one coat;

Total time—4 m.h.
Time per foot—.10 m.h.

4. *Pot head on pole*—Set on end of 3-inch conduit 45 feet from base of pole. Equipped with 3-inch conduit coupling, no mounting straps. Cable was 3 conductor 1/0 load, 7500 volt.

Total time—7.5 m.h.

5. *Pot head in vault*—Included fastening steel shelf on wall to hold pot head and the necessary work to fan cable to enter wires and solder in pothead. A utility man wiped lead cable to pothead joint in 3 hours including assembling his material.

Wiping joint—3 m.h.
Installing pothead—11 m.h.

6. *Pulling primary cable*—The total length was 626 feet. Pulled in two sections, one 391 feet, manhole to building and the other 235 feet, manhole to pole. In both cases a power pipe threading machine with universal drive and a heavy windlass was used. Cable was 3 conduit 15000 Volt VC lead 1/0;

Time to pull cable—35.5 m.h.
Average time per hundred feet—5.67 m.h.

7. *Splicing cable in manhole*—The cable was 15000 volt 3 conductor 1/0 VC and lead. Job took one roll of oil linen tape and one gallon of compound. The cables were connected with sleeves which were very neat to work with and saved much time over the old way of sewing the cable wires together. A utility man wiped the lead joint and formed the compound.

Making splice—12.25 m.h.
Wiping and compound—5 m.h.
Total time—17.25 m.h.

8. *Cable hangers*—Installed in manhole. Four hangers were fastened to the side walls with lead anchor;

Total time—1.5 m.h.
Average per hanger—.375 m.h.

The above figures are actual time studies and do not include non-productive or supervisory allowance. (*From A. F. Gould, Central Electric Company, Battle Creek, Mich.*)

INSTALLING ROOF EXHAUST FANS

Electrical contractors who engage in the sale of ventilation equipment are often called upon to quote installed prices for one or more units. Here is a case involving four exhaust fans that were to be mounted in separate penthouses on the roof of a two-story industrial building. Arnold Kleiner, electrical contractor of Newark, N. J., submits the following data.

Furnish and install two fans of 40-inch size, and two of 32-inch size, weighing 270 and 125 pounds respectively. Wire from nearby power feeders on separate 220-volt circuits, in exposed armored cable. Each unit to have an individual externally operated switch. The work involved these operations—

1. *Unpack and hoist to roof*—Fans and metal pent houses delivered in alley and hoisted over brick parapet to gravel roof of two-story building—

Total time—4 m.h.
Average per fan—1 m.h.

2. *Layout and cut openings in roof*—Wood and gravel roof structure, with mill construction roof framing—

Total time—6 m.h.
Average per fan—1.5 m.h.

3. *Set mounting flanges and grilles*—Bolt flanges to roof, flash openings and apply waterproofing—

Total time—6 m.h.
Average per fan—1.5 m.h.

4. *Install fans in pent houses*—Bolt fan frames to pent house structure, mount grilles—

Total time—4 m.h.
Average per fan—1 m.h.

5. *Set switches, run cable and connect fan motors*—Four runs of No. 14 2-wire armored cable approximately 40 ft. long.

Total time—8 m.h.
Average per fan—2 m.h.

6. *Total labor for four exhaust fans* —28 m.h.

Average per fan—7 m.h.

NEW HAMPSHIRE ENGINEER—In charge of construction work for the pioneer firm of A. L. Franks & Co., in Manchester, N. H., we find R. J. Sanborn. He has been on the job for 23 years, so draws on this experience to do engineering work for local architects on larger projects. The Franks firm has operated in Manchester for 48 years. A $32,000 hospital wiring job is nearing completion, also extensive fluorescent lighting for a local cigar factory.

FLUORESCENT LIGHTING COSTS

Analysis of an installation of fluorescent tube lighting in a Middle Western store gives the following experience data—

The job involved furnishing and installing a total of 110 thirty-six inch and 17 eighteen inch daylight fluorescent lamps connected to existing wiring circuits. About ⅓ of the installation required fitting the wiring trough to wood trim around the walls at a height of 7 feet 6 inches. The remaining trough was ceiling mounted at 12 feet forming a rectangular network.

The trough, lampholders and reactors were assembled and wired in the shop to measurements taken at the job. The

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Not only does the sale of these systems net you attractive commissions but each one also provides the opportunity to sell wire, batteries and accessory equipment.

Automatic Electric, originators of the automatic telephone, has been making both public and private systems for fifty years. Shown below are four of the many types of private systems available. Our field representative will be pleased to supply you with literature, prices and discounts as well as to work with you on particular jobs. Talk to him.

INTERCOMS

Common-talking, selective-ringing systems in capacities of two to eleven stations. Beautifully designed and durably constructed for long, faithful service. Operate from dry cells or battery eliminators.

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Attractively priced common-talking systems in capacities of two to ten stations. Conveniently packaged, simple to install. Operate from dry cell batteries.

AUTO-COMS

Deluxe intercom. Systems, providing selective talking and selective signaling service for a maximum of ten stations, and up to five connections at one time. No automatic switchboard needed.

P-A-X's

Private Automatic Exchange systems, available in all capacities. Use standard automatic telephones and provide for a variety of special communication services.

These systems are for private service only. They cannot be connected with the public telephone system.

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All over the country, in large cities and small towns, thousands and thousands of merchants are realizing the vital importance of efficient lighting —are learning that Sterling Lite-Flo Reflectors can give them amazing improvement in show window lighting with the same operating cost — learning that STER-LITE Louver-Controlled Direct-Lighting Units offer the ideal light for store interiors.

And Contractors everywhere are finding Sterling Products offer the PLUS VALUE that wins commercial wiring contracts.

Catalog and Sterling Co-operative Sales Plan for Contractors mailed promptly on request.

STERLING REFLECTOR CO
1435 W Hubbard St CHICAGO

Estimating

[FROM PAGE 68]

store was occupied and the installation was made without interrupting business. The figures therefore include some overtime.

Labor analysis of total job—m.h. per lamp—2.44. There is no appreciable difference in labor cost for the various lamp lengths.

Total major material items—

380 wiring trough
127 pairs lampholders
127 reactors
110 36-in. daylight lamps
17 18-in. daylight lamps

Labor breakdown—

	Man Hours
Measuring up job	16
Removing old equipment	12
Shop assembly of trough	90
Wiring—(shop)	64
Installation on job	56
Wiring and connections	26
Painting	12
Lamping	4
Non-productive and supervisory	30
Total labor hours	310

Analysis of breakdown—

Assembly and installation—m.h. per lamp—1.15.

Wiring—m.h. per lamp—.71.

Painting—m.h. per foot—.03.

Lamping—m.h. per lamp—.03.

Supervisory and non-productive—m.h. per lamp—.24.

Miscellaneous—m.h. per foot—.07.

Note—assembly and installation, wiring and lamping supervisory are computed as functions of the number of lamps. Painting and miscellaneous are functions of the number of feet of wiring trough.

Wiring, painting and lamping are fairly constant items. These will vary within narrow limits on different types of jobs. Assembly and installation costs will vary widely with different installations and a suitable allowance for installation difficulties must be included for each job. At the present time supervisory, non-productive and testing costs are a comparatively high percentage of the labor cost because fluorescent lighting is still unfamiliar material to the average mechanic.

POLE HANDLING

On an REA line project near Norman, Oklahoma, the Scherrer Construction Co. of Kansas City, Mo., are setting poles at a rate of 60 per 8 hour day in holes averaging 5½ feet deep. Three men with a "Caterpillar" tractor equipped with 16 inch auger and pole derrick, dig the holes and set the poles ready for a five man tamping crew.

POLES SET *in quick time with this tractor and boring machine equipment on an Oklahoma REA line project.*

The average time for boring in decomposed hard red sandstone is 1.65 minutes per hole, to set pole before tamping .75 minutes and moving from one pole setting to the next stake, distance varying from 300 to 325 feet, 1 to 1.3 minutes depending upon obstacles encountered. Fuel and oil for the tractor and boring machine averages 15 gallons in 8 hours, a change of oil every 60 hours and 1½ pounds of grease per day.

MANHOURS CONSUMED IN ESTIMATING

Since publishing an article in January "The Breakdown of a $10,000 Cost," we have been asked to explain an item of $22.00 that was listed as "Estimating Cost." This raises the question of what is to be considered a reasonable cost for estimating a $10,000 high school installation like this one. Detailed figures from John Teufel of Hartford, Conn., provide this further data—

"The estimating man-hours required to complete the Suffield High School job were—

32 Hours Estimator at $2.25 per hour	$72.00
24 Hours Clerk & Stenographer at 75 cents per hr	18.00
Total Estimating Cost	90.00
4 Sales of Estimates at $22.00 each	88.00
Net Loss	2.00

"I find that it is impossible to forecast the number of sales on any job until a selling price for the estimate has been established. However, I usually average four sales per job, and use that figure as a means of arriving at my selling price."

YOU CAN'T BE THE *First*
YOU DON'T WANT TO BE THE *Last*

One of Niagara Hudson's Five Star Model Homes

The Wright Building, Toronto is Nofuze protected

to get these profitable Nofuze contracts

There is money to be made . . . and this time the opportunity is knocking at the electrical contractor's door. You have seen how the builder increased his profits by recommending modern improvements . . . insulation, colorful interiors, modern convenience. You have seen the plumber cash in on modern bathroom fixtures . . . copper piping.

Now it is your turn . . . selling fuseless circuit protection and adequate wiring. Westinghouse Nofuze protection is available for every electrical circuit — for old and new homes, for office buildings, stores, commercial buildings, factories. Over 3,000,000 electrical circuits are now Nofuze protected.

Get on the band wagon . . . let the idea of safe, convenient circuit protection open the door to new profits, in *your* business. Ask your nearest Westinghouse wholesaler to demonstrate Nofuze equipment and to tell you how Nofuze protection helps the electrical contractor make money.

Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

J-60297-A

Nofuze Multi-breakers for homes

Nofuze power panelboards for industrial plants

Nofuze lighting panelboards for commercial buildings

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AN ENTIRELY NEW IDEA IN SURFACE WIRING!

EASIER FOR YOU TO INSTALL . . .

● The basic difference between Porcelain Products' SURFOLETS and all other surface wiring devices lies in the fact that a SINGLE BASE serves for switches, outlets, pendents, lamp bases, etc . . . everything you need for a complete wiring layout, even to "blanks" for adding devices or extensions later. All you have to do is plot the location of the various units required or anticipated, install the same standard base at all such points, and complete the job by covering each base with the proper device. Think how much more profitable such jobs can be from the standpoint of the hours saved by this unique STANDARD BASE PRINCIPLE . . . and how much easier it will be to sell surface wiring when you can show that it . . .

COSTS YOUR CUSTOMER LESS!

● Here, indeed, is a welcome means for broadening the field in which to sell your services. Many times, probably in your own experience, wiring jobs have been lost because a prospect can't pay the customary price for the kind of job he requires. With the savings made by this unique STANDARD BASE PRINCIPLE, however, you can easily overcome price resistance and still offer a quality installation with an entirely satisfactory margin of profit. Let us tell you more about SURFOLETS and how they can help you MAKE MORE MONEY.

PORCELAIN PRODUCTS, Inc.
FINDLAY OHIO

Your Legal Rights

[FROM PAGE 13]

Fourth, the party making the improvement must intend that it shall become a permanent and component part of the real estate as a whole.

Fifth, the apparent purpose of the improvement must tend to show that it was to be of a permanent nature.

No one of these rules can be said to be decisive in all cases, but taken together they will usually show what the actual result should be. Certain classes of material may in one instance be considered an improvement to the real estate and thereby lienable, and the identical material be considered to be purely a "trade fixture" in another instance and therefore not lienable. A good example of this class of material is electrical lighting fixtures.

It is my opinion that the same rules are applicable to electrical fixtures that are applicable to any other class of material. If fixtures are furnished at the instance of the owner in the erection of a new building, and are of the type ordinarily used, and are installed in the customary manner, they are as much a part of the building as the receptacles and plates or the concealed wiring and therefore constitute a lienable improvement. If, on the other hand, the fixtures are for replacement, are particularly adapted for use by a tenant, are installed at the instance of such tenant, and the building is such that it is not constructed specially for the type of business which this tenant is operating, then they would not be of a lienable character. These are the two extremes.

When a Lien Starts

6. But assuming that there is no question as to the lienable character of the improvement, the owner may prevent the lien of any person contributing to the improvement by giving written notice to that person that the property shall not be subjected to a mechanic's lien. Within five days the owner may post a notice on the premises and bar the lien rights of all who may contribute to the improvement. Therefore, you should be sure that the owner has notice that you intend to contribute to the improvement at least five days before you start the work.

Your lien attaches at the moment any first item of labor or material furnished on the premises for that particular improvement. If a mortgage is recorded with the register of deeds before the first visible contribution to the improvement is made, your lien is subordinate to the mortgage. Actual knowledge on your part that such a mortgage exists has the same effect as recording.

7. So be careful not to sign anything that has a suggestion of being a lien waiver until you receive full payment. A plain receipt is protection enough for the owner. Also, if you expect to rely upon your lien, never agree to terms which extend the date of payment beyond 90 days after completion of your part of the improvement, nor to terms which make the date of payment indefinite or dependent upon a contingency.

The lien must be filed within 90 days after the last item of work or material is furnished by you. And do not hesitate to file a lien for a small claim.

Time for Action

8. The statutes prescribe the time within which an action must be commenced to enforce a right. Technically, the right is never removed. It is merely the remedy which is removed. But actions on claims of the type arising out of contracts, for goods sold and delivered, on stated accounts, and on promissory notes, must be commenced within six years from the date when an action could have been commenced. If the claim is taken to judgment it is then extended for a further period of ten years.

A judgment in the district court becomes a lien on any real estate in the county in which the judgment is filed, whether owned at the time of filing the judgment or acquired later during the ten year period. So no purchaser will be willing to take the property as long as your judgment is on record and alive. This fact operates to give your judgment a nuisance value.

9. During the past few years many small corporations have been dissolved and reorganized as partnerships for saving taxes. For in addition to corporation income taxes, the members of a corporation also must pay a similar tax as well as unemployment compensation taxes on their salaries. Partners need not pay either of these taxes on their salaries or withdrawals.

The disadvantage of unlimited individual liability for partnership debts still accompanies the partnership structure. However, partners may protect themselves by carrying various forms of insurance to cover almost any loss. If you do decide on the partnership form, then be sure that your partnership agreement is carefully drawn.

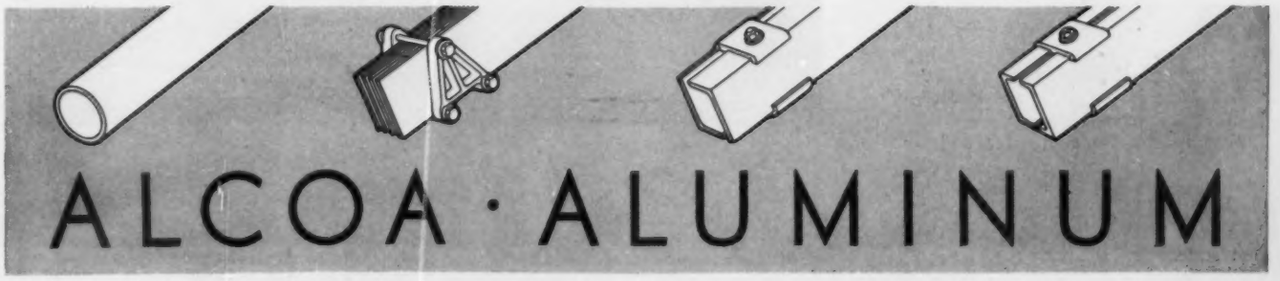
OLD TIMERS, THESE ALCOA ALUMINUM BUSES

—but still going strong!

PUT TO WORK in 1898, this outdoor Aluminum bus has been on the job 41 years; exposed to all kinds of weather, carrying enormous electrical loads. The switchboard installation, 25 years old, has had heavy going in supplying power to a street railway feeder.

Both old timers, yes, but as ready for a continued siege of service as on the day they were installed. Showing the long life and dependability you can expect with Alcoa Aluminum bus bar.

Whatever your bus bar requirements, you'll find lightweight, Alcoa Aluminum shapes suited to the job; flats, tubular, angles and channels. Joints are made by bolting or welding. Inexpensive, standard fittings are available. Our engineers will gladly help solve your bus bar problems. ALUMINUM COMPANY OF AMERICA, 2197 Gulf Building, Pittsburgh, Pennsylvania.



In the News

LLOYD HEADS INSPECTORS

Morton C. Lloyd, chief of the Section of Safety Codes, National Bureau of Standards, Washington, D. C., was elected president of the Executive Council of the International Association of Electrical Inspectors. He will serve for the year 1939 to 1940 according to an announcement by V. H. Tousley, secretary on May 1st.

Other officers elected for the coming year are: K. W. Adkins, St. Louis, first vice-president; G. E. Kimball, San Francisco, Calif., second vice-president; H. A. Patton, Seattle, third vice-president; T. W. Bowry, Richmond, Va., fourth vice-president; and V. H. Tousley, Chicago, secretary-treasurer.

The normal line of succession was broken this year by the request of F. N. M. Squires, former first vice-president, of New York, who asked to be relieved of his national executive duties due to the pressure of his local work. He will carry on, however, as an officer of the Eastern Section. G. E. Kimball of San Francisco takes over the position vacated by the death of C. E. Hardy of Oakland, Calif., formerly third vice-president.

NORTH CAROLINA MOVES FORWARD

North Carolina electrical contractors met in Charlotte on May 19 for their annual convention. Their program revolved around plans for the coming year designed to advance the industry in three directions. Estimating classes will be held in the larger centers to raise the standards of estimating practice. A program for improving trade ethics will be promoted to foster price courage and a franker cooperation between the contractor, wholesaler and manufacturer. And third, a closer coordination is to be affected with national programs of market development, with special emphasis on adequate wiring.

Laurence W. Davis, general manager of NECA told of the work now being done nationally for the contractor and complimented the North Carolina Association on its progress. F. J. McGinnis, Palm Beach contractor and secretary of the Florida State association brought greetings from that state.

High point of the meeting was a banquet at the Hotel Charlotte, with John Paul Lucas of the Duke Power Company as toastmaster. Roy A. Palmer of Duke Power demonstrated the possibilities of color lighting and George Wheelright of the Polaroid Corporation indicated by experiments the coming part that polarized lighting is to play.

Earl Whitehorne, editor of *Electrical Contracting* made the principal address, stressing the fact that wiring has become the No. 1 problem of the electrical industry. He urged the contractor to improve himself as a business man and as a salesman that he may himself enjoy the prosperity that will come from this great market and not go to other men who will come into the field, if he does not meet the urgent public need.

The following officers were reelected for another year—president, O. W. Holmes of Fayetteville; vice president, E. C. Peele of Burlington; secretary, Frank Hartis of Durham; treasurer, D. J. Thompson of Raleigh.

CODE SPONSORS MEET IN CHICAGO

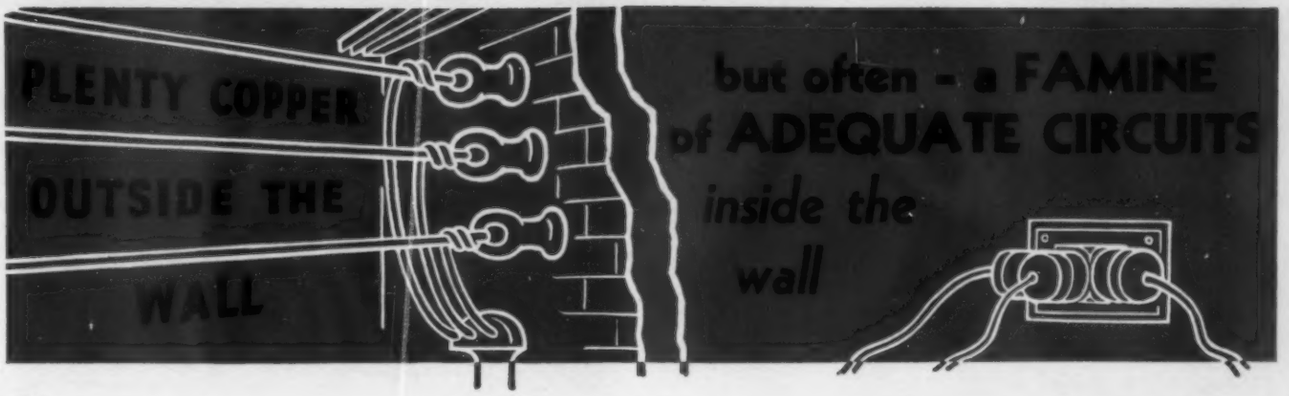
Reports of committees, on electrical safety, before the annual meeting of the National Fire Protection Association in Chicago on May 10, passed without detailed presentation of changes proposed by article sub-committees for the National Electrical Code. A number of proposals were made by the article committees on May 1 and will be published July 1 for industry discussion pending the meeting of the Electrical Committee in December.

The electrical session started off with a report on electrical field service by A. R. Small, Chairman and Victor H. Tousley, Electrical Field Engineer. They indicated that no changes in the field service program will be made in the coming year. Speaking for the Electrical Committee, Mr. Small announced that hereafter there will be a new code every three years, starting in 1940, instead of at two year intervals as heretofore. This new schedule will permit more general discussion of proposed code changes by interested organizations by permitting longer periods to elapse between the action of the committees through which the changes are initiated.

Discussion of proposed changes in wiring methods and materials was limited to alterations in the rules covering current carrying capacities of conductors and types of insulation. The extensive analysis and tests of electric fence systems made by the Underwriters' Laboratory was described by H. B. Whitaker, who illustrated his talk with movies and projected charts. Through tests on animals and humans basic standards for the design of electric fence have been determined to insure against currents dangerous to life or property.

ADEQUATE WIRING booth staged by Seattle electrical contractors at a recent National Housing Exposition. R. D. Horning, manager of the contractor association, headed the committee of the Seattle Electric Club with which wholesalers, manufacturers, utilities and the local Union cooperated. Inspecting the exhibit, left to right, L. M. Wolfe, Anaconda Wire & Cable; S. G. Hepler, Arrow Electric Company; Burt R. Cole, Graybar; and R. D. Horning, Seattle Electrical Contractors Association.

The FUSTAT can help correct this condition



It shows user need for new circuits

Permanent overloading is positively prevented. Once the correct size Fustat has been installed it cannot be replaced with a larger size and bridging it in any way is virtually impossible. If additional circuits are needed the user cannot side-step the issue at the sacrifice of safety.

It reduces low voltage complaints

The user cannot load the circuit beyond the proper capacity of the copper. This prevents a voltage drop that is so frequently the cause of complaints about toasters, percolators and other appliances not operating efficiently.

It permits more outlets per circuit

Adding a maximum number of outlets is a perfectly safe practice because the Fustat guards the circuit against overloading.

It guards against blowing of main fuses

The branch circuit Fustat will almost invariably open on a short-circuit or overload, AHEAD of the main fuse or Fustat — because it cannot be replaced by an oversize fuse or readily tampered. When it does open to protect, only the *normal load* of one circuit is off the line instead of a user possibly having all of his lights and appliances out of service because the main fuse blew.

It permits adding more appliances to present circuits

A circuit can be loaded to approved capacity without needless blows and without sacrifice of safety. The long time-lag of the Fustat keeps it from blowing on motor starting currents or other harmless overloads.

It builds user confidence in doing things electrically

The Fustat helps sell the electrical way of doing things — for it generally permits users to add new appliances without being annoyed by needless blows . . . it assures proper operation of appliances because low-voltage cannot be caused by overloading . . . it reduces chances of users being frightened by shorted cords burning up, for the quick action of the Fustat on dangerous cord shorts — prevents spraying of metal, starting of fires, burning of users . . . it helps teach user that the protective device is a desirable safeguard instead of a nuisance . . . **thus it assists the whole industry to build towards bigger business and better times.**

WHAT IS THE FUSTAT?

It is a fuse to which a thermal cutout is added.

It protects like a fuse against short-circuits — even high resistance shorts such as occur in flexible cords.

It protects against permanent overloads, even when as light as 25%.

Yet it will not blow on motor starting currents of washing machines or other appliances.

It has a base that guards against anyone robbing the circuit of protection.

It fits Edison base fuse-holders through the use of an inexpensive adapter.

Retails at 7½c

It's just good business to sell, install and use Fustats

The FUSTAT

For full information write to any of these firms

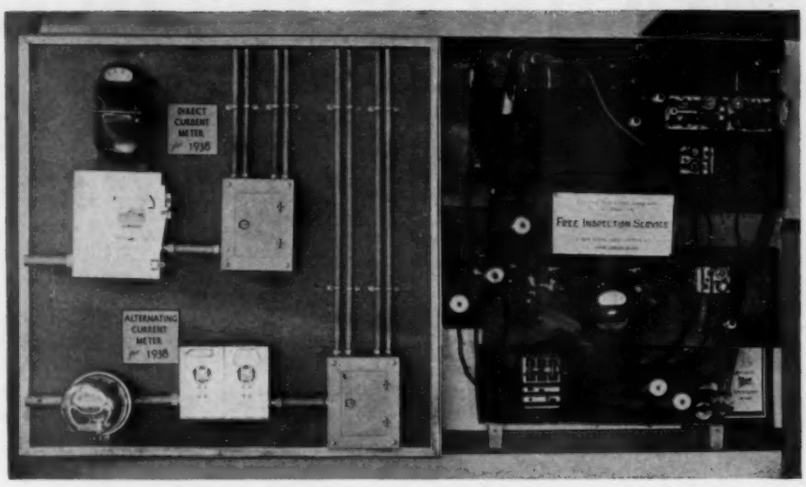
BUSSMANN MFG. CO., University at Jefferson, St. Louis, Mo.
JEFFERSON ELECTRIC COMPANY, Bellwood, Ill.
KIRKMAN ENGINEERING CORP., 121 Sixth Ave., New York City
NATIONAL ELECTRIC PRODUCTS CORP., Fulton Bldg., Pittsburgh, Pa.
UNION INSULATING CO., 27 Park Place, New York City

Retails at 7½c
in 15 to 30 amp. sizes

ATTIC VENTILATORS APPROVED FOR EHFA FINANCING

Attic ventilating fans may now be financed on EHFA time payments through the rewiring campaign of the Chicago Electric Association in cooperation with Electric Home & Farm Authority. To come within the plan some permanent wiring must be included as a part of the contract.

This action further extends the convenience of time payment contracts available to electrical contractors in the Chicago area. Through the resources of EHFA with the cooperation of the Commonwealth Edison Company, unpaid balances in excess of $40 for rewiring may be financed on a down payment as small as 10 per cent of the job. The finance charge is 5 per cent per year over a period as long as 24 months on the original unpaid balance. The monthly payments are billed and collected on the electric service bills by the Commonwealth Edison Company.



CAMPAIGN AMMUNITION—For several years past the Clark & Mills Electric Co. has conducted a fall free-inspection campaign for re-wiring, from its Boston and Cambridge offices. Here is a display board developed by them to show the contrast in obsolete and modern wiring. The October 1938 drive produced residential wiring contracts totalling $19,004 in 25 working days. A quota of $12,000 had been set. The extra cost of this campaign was $1,384, which included $578 paid in commissions to the salesmen and wiremen who closed the orders. Incidentally, journeymen were responsible for contracts totaling $3,754.

BOSTON HUNTING ELECTRICAL HAZARDS

Interior wiring in apartment houses, stores, factories and industrial plants in all sections of the City of Boston is being investigated by inspectors of the Wire Division of the Boston Fire Department. Apartment houses and stores come first under the present reinspection program, which is being directed by Bernard B. Whelan, Superintendent of the Wire Division. A surprising number of hazards are reported by inspectors in their regular districts. These hazards predominate:

1. Apartment tenants buying cheap material and having it installed by the janitor or general "handyman."
2. Cords stapled to baseboards and run through holes and doorways.
3. Mains frequently over loaded.
4. Joints not soldered or properly taped.
5. Open wiring hanging in basements.
6. From twenty to thirty outlets supplied by the same circuit. Because of the cooperation received from the general public, no legal action has been necessary so far to secure correction of hazards.

'Yea, he said too many customers came crowdin' in during the hot weather. It made him sore."

CHICAGO UTILITY PAYS RANGE RE-INSTALLATION COST

Beginning May 15, 1939, the Commonwealth Edison Company of Chicago will pay regular installation allowances toward the cost of reinstalling electrical ranges and water heaters for customers who move, within two years from the date of original installation, to a new address served by the company.

The new ruling is intended to open new markets among renters who have heretofore hesitated to buy electric ranges or water heaters for fear they might move within a year or two and have to pay to re-install these appliances.

The allowance for range and water heater installations which will now apply to re-installation are as follows:

Range circuit allowance—$25 per range. Includes providing adequate service switch capacity, three wire circuits arranged and range receptacle.

Water heater circuit and plumbing allowance—$43 per water heater. Includes wiring for meter fitting to water heater, installing separate service switch and plumbing necessary to install water heater.

Service—wiring capacity allowance:

1. Where meter has previously been moved out of doors—$14 per building.
2. Where meter is moved out of doors in connection with range or water heater installation—$10 per building. Includes replacing existing service from service head to meter fitting with one adequate for

"Fix me up on this list, please

I'm wiring the house myself"

CUSTOMERS like this make many interesting discoveries about electricity which keep your fuse department busy and the Fire Department on the run. They pay no attention to local laws or the provisions of insurance policies—and they and their families live in cheerful ignorance of the imminent danger of fire and sudden death. Their amateur wiring in the bathroom makes the tub a potential electric chair. But they certainly do eliminate the middleman in the electrical field—as far as possible. Fortunately, intelligent advertising, education via safety campaigns, and good common sense have made most people realize that the proper wiring of even a modest home is a job for the skilled electrical contractor. And when they pay his bill, they know it is a long range guarantee of economy, reliability, and safety.

When the electrical contractor buys insurance from the experienced agent or broker of a stock insurance company, he does not say "$50 worth of insurance, please." He asks for and gets the advice and full services of an expert purchasing agent in the complex insurance field, like himself an expert middleman. No worries about uncovered risks that might wreck a business.

* * *

Because we believe so thoroughly in the services of an expert middleman whether wholesaler, electrical contractor, insurance agent or broker, we refuse to accept business direct because it is not in the interest of the Company or the assured to do so. When *you* buy National Surety Fidelity Bonds, Surety Bonds, Burglary or Forgery Insurance through your local insurance agent or broker, you deal with a customer and friend who is a fellow member and supporter of the American Business System.

NATIONAL SURETY CORPORATION

VINCENT CULLEN, President

RUBBER COVERED POWER CABLES • BUILDING WIRE • VARNISHED CAMBRIC • FLEXIBLE CORDS • LEAD ENCASED AND PARKWAY CABLES • ARMORED CABLE • CRESFLEX NON-METALLIC SHEATHED CABLE • SERVICE ENTRANCE CABLE • MAGNET WIRE • BARE WIRE

COAL MINES Use It! . . . . .

Where safety of human life and limb as well as uninterrupted production depend on a constant flow of current for power and light, you'll find Crescent Wire and Cable among the chosen few.

Imperial Cable, shown at the right, is an all-rubber portable cable which combines every feature of toughness, durability and safety required in the severe duty encountered in and around mines. Also, you can count on it to fill, with entire satisfaction, the most difficult portable cable installations.

ADEQUATE WIRING SERVES AND SAVES

CRESCENT
INSULATED WIRE & CABLE CO. INC.
TRENTON, NEW JERSEY

Atlanta Baltimore Boston Buffalo Chicago Cincinnati Cleveland
Detroit Indianapolis Kansas City Los Angeles Minneapolis
New Orleans New York Philadelphia Pittsburgh St. Louis San Francisco

CRESCENT ENDURITE SUPER - AGING INSULATION

In the News

[FROM PAGE 76]

future requirements, including ranges.

Additional service—wiring capacity allowance—$7.50 per building. This applies to three family dwellings only where capacity for three ranges is installed.

Meter moving allowance—$12 per meter. For moving meters out of doors, no allowance is made for installing water heater meter.

GEARY TO NECA LABOR RELATIONS WORK

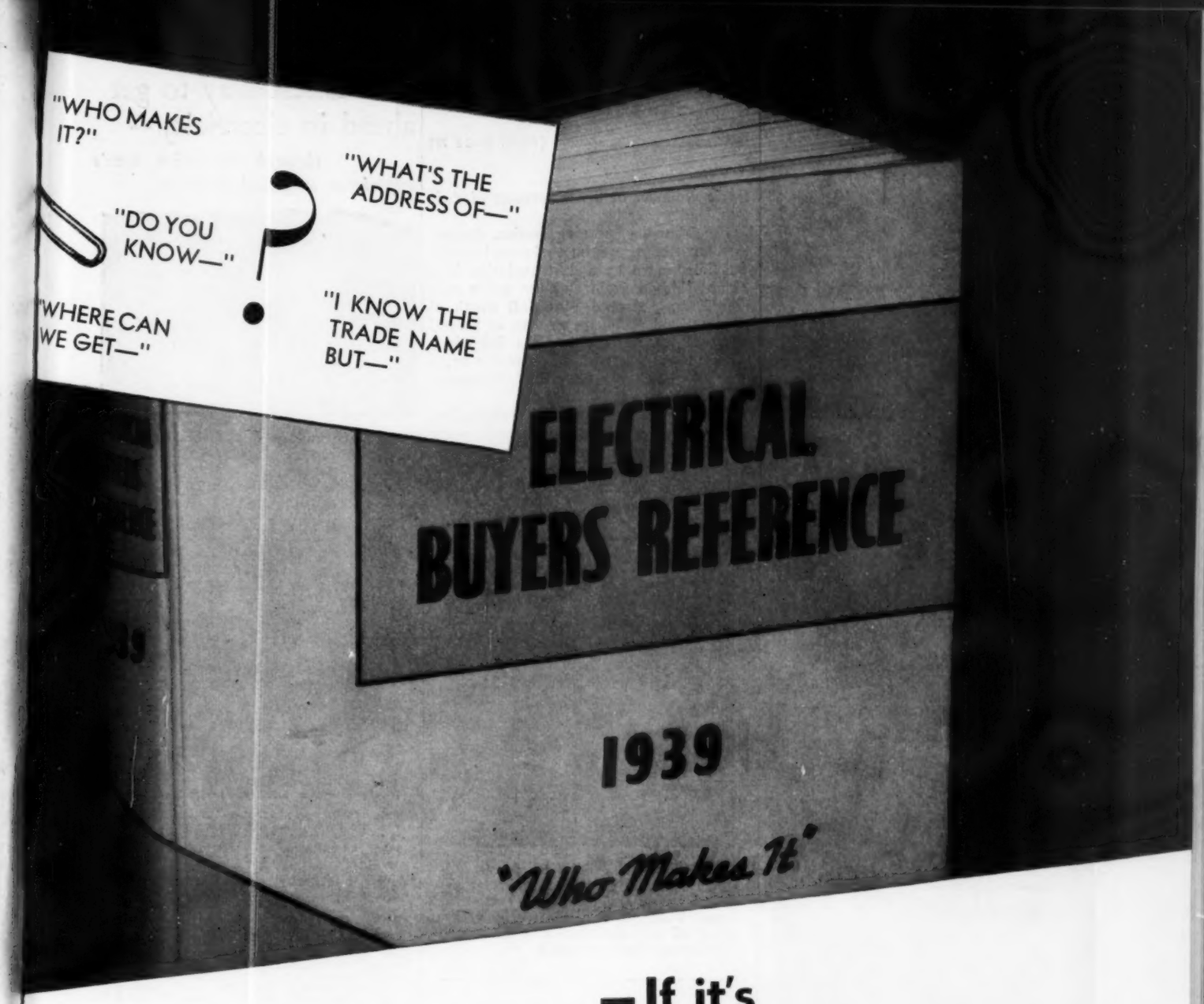
The National Electrical Contractors Association has secured the services of P. M. Geary of Youngstown, Ohio, as field representative for the Labor Relations Committee. Mr. Geary is well known among NECA members, having been full-time secretary of the Electrical Contractors Association of Youngstown until assuming his new duties on May 1st. He also managed the Steel City Installation Company, an organization set up by twelve local contractors to handle range wiring under mass production methods.

P. M. GEARY—*NECA field man on labor relations.*

Mr. Geary's first duties in the NECA organization will be to visit various cities throughout the country for the purpose of acquainting employers in the electrical contracting industry with the work of the Labor Relations Committee, and to secure their cooperation with its objectives.

TRAGIC DEMONSTRATION

Fire marshals, insurance underwriters and electrical inspectors who attended the meeting of the National Fire Protection Association in Chicago on May 11 had a



—If it's

"INFORMATION, PLEASE"

—turn to this storehouse of buying data!

From cover to cover, the Electrical Buyers Reference has been built, year after year, with the single purpose of telling quickly and accurately what you want to know about thousands of electrical and allied products —made by hundreds of manufacturers. Make it your FIRST place to look for buying information.

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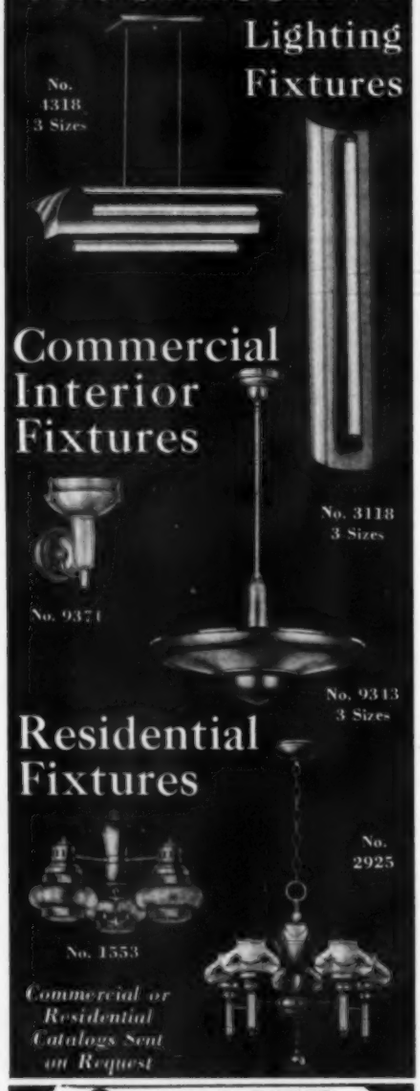
Modern, Efficient Lighting *with* EFCOLITE Lighting Fixtures

FLUORESCENT Lighting Fixtures



EFCOLITE CORPORATION TRENTON NEW JERSEY

In the News

[FROM PAGE 78]

tragic reminder of the importance of their task.

The Thursday morning session, devoted to committee reports on explosion hazards, was interrupted by a dust explosion in a South Chicago grain elevator which took nine lives, destroyed $4,000,000 worth of property and shook up an area of several square miles. The disasterous fire which followed was easily visible from the headquarters hotel of the Fire Prevention group.

Several of the country's outstanding authorities on explosion hazards were rushed to the scene. Their findings may add materially to existing knowledge on the destructive forces of dust explosions and their prevention.

LAURENCE W. DAVIS *addressed a large meeting of San Francisco electrical contractors while on his western tour. With him is Carl Severin, president of the San Francisco Electrical Contractors Assn. (seated)*

RULES ON RECESSED LIGHTING

Special rules applying to the construction and installation of concealed, recessed or flush type lighting fixtures have been prepared by the Department of Water Supply, Gas and Electricity, New York. They clarify the requirements for overcoming objectionable lamp heat hazards, where fixtures are placed in semi-fireproof and non-fireproof buildings. High spots in this 3-page Bulletin No. 17 are:

Fixture enclosures must be made of corrosive resistive metal, galvanized or zinc coated. Sheet steel enclosures up to 500 cu.in. area must employ No. 20 U. S. Ga. thickness and be increased by steps for larger areas up to No. 14 Ga. for enclosures of over 8,000 cubic inches area. They must have a total radiating surface of at least 3.5 sq.in. per watt of lamp rating and not less than 2.5 sq.in. per watt where reflectors are used in the fixture enclosure. Provisions for the use of asbestos board or rock wool covering for fixtures and the fireproofing of adjacent woodwork are outlined. Fixture wires must be carried in

The easiest way to get ahead in electricity—

through the other man's experience as found in books

Whatever "getting ahead" means to you as an individual, there is no principle so important as backing up your brain with the other man's experience. Why spend time and effort to find out what has already been learned and put down for all to see in books? Here, for instance, are all the results of a rich experience in every stage of wiring, installation and contracting work gathered and set down for you in

Terrell Croft's

AMERICAN ELECTRICIANS' LIBRARY

(6 volumes — over 2,000 pages — fully illustrated)

In six really magnificent volumes this library gives the most thorough, more complete and easiest-to-understand treatment of the more specialized phases of electrical practice in print today.

"How" and "why" for Maintenance Men

The books show the best ways to make installations for every type of conduit wiring job—they tell how to handle every kind of lighting and switch problem—they give tips on short-cuts for saving time on routine jobs—they show the quickest and surest methods of locating and remedying circuit troubles. Alternating current armature winding, electrical machinery control diagrams and machinery erection are some of the things covered in detail.

Diagrams

In all, these books contain more than 1,000 clear, easy to follow diagrams, with wiring instructions written in simple language. It is unnecessary to tell you how valuable is this one feature alone.

Small monthly payments

You may examine these books for 10 days by sending the coupon below, filled out. In addition, if you decide to keep the books you have the privilege of paying for them in easy monthly installments while you use the books. Make sure you are not passing up your best bet for getting ahead. Mail the coupon today.

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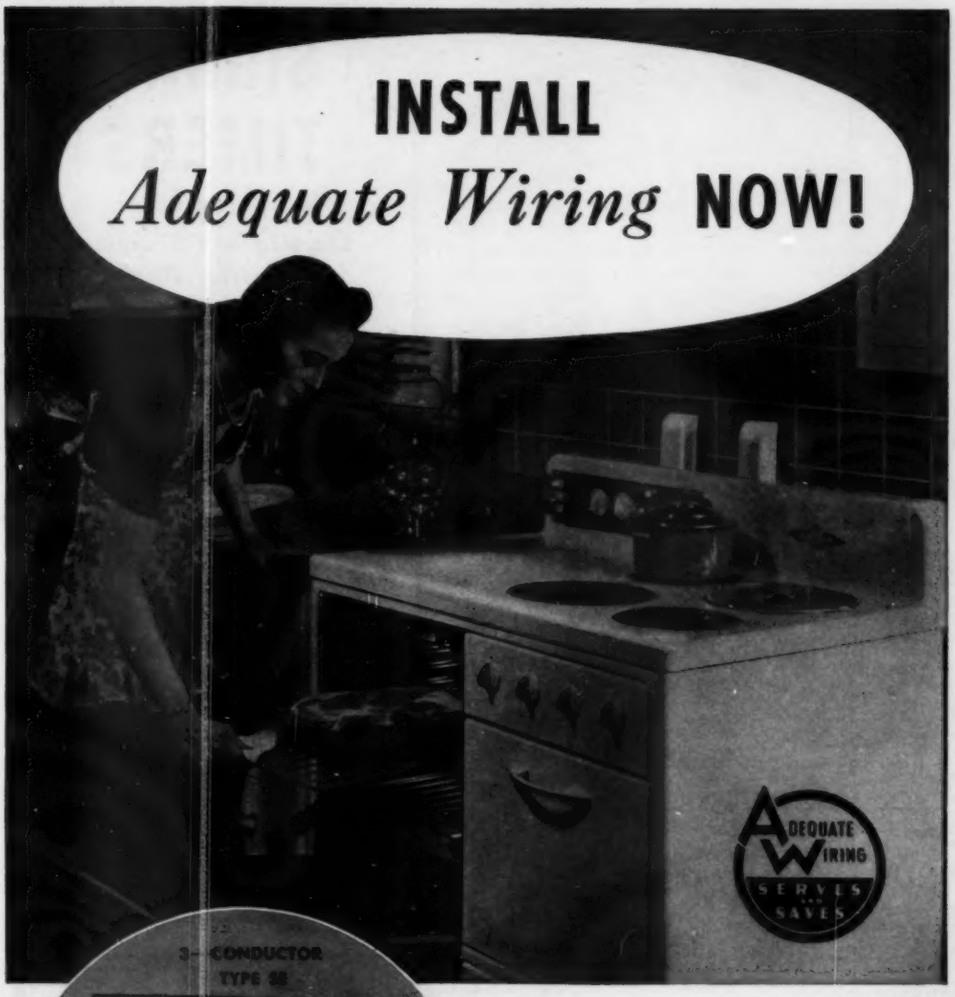
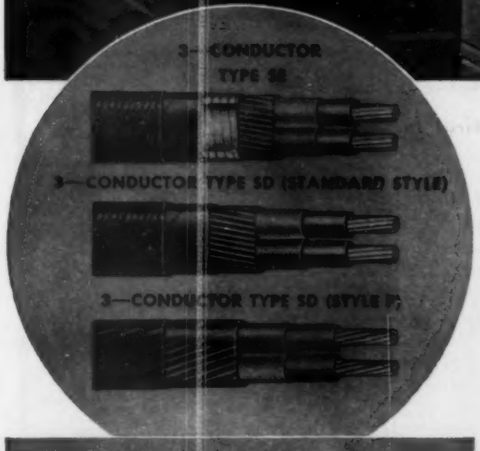
INSTALL *Adequate Wiring* NOW!





AMERITE
SERVICE ENTRANCE
and
DROP CABLES

SERVICE change-overs are made easy and economical with Amerite service-entrance and service-drop cables. There is a type for every purpose. "Tamperproof" cables (see cuts) eliminate diversion of current.

TYPE SE —Tamperproof Service Entrance cable. May be attached direct to building walls.

TYPE SD —Tamperproof Service Drop cable. May be run from pole to meter in one continuous length if properly protected where it contacts walls of building.

TYPE ASE—"Protected" type for use in places where exposed to mechanical injury.

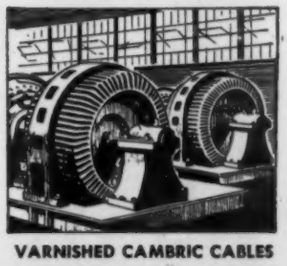
TYPE USE—Underground type for direct burial in earth.

We also furnish 5-conductor Service Entrance cables, useful for rewiring houses with Service Entrance in the attic.

Let us send you our Catalog of Service Cables.

BUILDING WIRES

PARKWAY CABLES


VARNISHED CAMBRIC CABLES

AMERBESTOS CABLES

TREE WIRE

AMERCLAD CORDS & CABLES

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UNITED STATES STEEL

USE G-E BUILDING WIRE

MARKED FOR QUICK IDENTIFICATION OF SIZE, TYPE AND VOLTAGE
GENERAL ELECTRIC – BUILDING WIRE – R
GENERAL ELECTRIC – BUILD
GENERAL ELECTRIC – B
12 – GENERAL ELECTRIC – B

You'll be certain of a dependable high grade job if you use G-E Building Wire. It is made from the best raw materials obtainable. It is checked and tested constantly during the manufacturing process.

Moreover G-E Building Wires are marked for quick identification of size, type and voltage. Different colored braids make circuit testing easy. All grades have the same uniform flame-retarding and moisture-resisting finish.

For further information, see the nearest G-E Merchandise Distributor or write to Section W-946, Appliance and Merchandise Department, General Electric Co., Bridgeport, Conn.

SEE THE HOUSE OF MAGIC

GENERAL ELECTRIC

In the News

[FROM PAGE 80]

flexible or rigid conduit to a standard outlet box or junction box located no nearer than 4 feet to the fixture. Such fixtures shall not be used as a splicing chamber for other circuits or as a raceway for other conductors.

COMING MEETINGS

Ontario Electrical Contractors Association—Hamilton, Ont., June 1.

Edison Electric Institute—Annual Convention, Waldorf-Astoria Hotel, New York, June 5–9.

New York State Assn. of Electrical Contractors and Dealers—Annual Convention, Higby's, Big Moose, N. Y., June 20–23.

Illuminating Engineering Society—Annual Convention, San Francisco, Calif., August 21–25.

International Association of Electrical Inspectors—Western Section, Hamilton, Ont., Sept. 11–15; Southern Section, Asheville, N. C., Sept. 18–22; Eastern Section, Providence, R. I., Oct. 2–6.

National Electrical Contractors Association—Annual Convention, Bellevue-Stratford Hotel, Philadelphia, Pa., Oct. 9–12.

National Electrical Manufacturers Association—Annual Conference, Palmer House, Chicago, Oct. 23–27.

CHICAGO CODE PUBLISHED

The 1938 revised Chicago Electrical Code which sets rules and regulations for electrical wiring within the city of Chicago was distributed to the local trade during the week of May 8. This revision, the first since 1931, follows closely the provisions of the National Electrical Code and was passed by the Council late last year.

Electrical Inspectors anticipate several months of educational work after the edition gets into the hands of contractors before new rules become generally familiar to the trade.

PROPELLER FAN MAKERS ORGANIZE

The National Association of Fan Manufacturers has recently sponsored the organization of the Propeller Fan Manufacturers Association. The reason is the growing importance of propeller fans in ventilation. Following several meetings held this year in Pittsburgh and Detroit, by-laws were adopted, and the following officers elected: M. W. Bauer of the Aerovent Fan Company, president; A. R. Stephan of the DeBothezat Ventilating Equipment Co., vice-president; and V. C. Shetler, secretary and treasurer.

There are fifteen charter members in

SIGNAL TIMERS

FOR

Starting and Stopping Industrial Work

Marking School Class Periods

Sounding Municipal Time Signals, etc.

Furnished with from one to six permanently set signal periods, for any times desired, but more than five minutes apart. Additional signal periods at little added cost. The schedule can be changed at the factory any time a different program is wanted.

$30.00

With addition of *both* a "Manual Control" and "Sunday and Holiday Cutout", $35.00.

AUTOMATIC ELECTRIC MANUFACTURING CO.
MANKATO, MINN.

this new association. A certified rating label is planned which will be issued only to those member companies whose ratings and tests are in accordance with the Standard Test Code for Centrifugal and Propeller Fans adopted jointly by the National Association of Fan Manufacturers and American Society of Heating and Ventilating Engineers.

ADEQUATE WIRING THIS MONTH

More news comes trickling in about the Adequate Wiring Campaign activities about the country. Here's the nubbin of it—

Dallas—The local FHA office now accepts certificates from the local A/W Bureau as evidence that a house is of superior construction. This affects their appraisal and loan.

Minneapolis—No. 1 Certificate was issued to the Minneapolis Modern Life House, the first of eight houses being sponsored by "Life".

Norfolk—Here starts the 24th local group issuing certificates, covering Norfolk, Portsmouth, Virginia Beach and two counties.

Arlington, Va.—First certificate issued.

Lexington, Ky.—Four power companies have tied up in a joint A/W Campaign.

Madison, Wis.—Wisconsin Power & Light Company has launched a campaign to cover 294 towns and 15,000 rural consumers.

Greenville, Ohio—An all-industry group is organizing, following a meeting sponsored by three power companies.

Beaumont, Tex.—Two electric homes have been opened to demonstrate wiring and what it does for you.

New York—Five homes in the "Village of Tomorrow" at the World's Fair have been used to demonstrate adequate wiring and the first A/W certificate in the Metropolis was issued to a home on Staten Island.

EASY PAYMENTS FOR WIRING

In rural Washington, wiring can be financed under Electric Home and Farm Authority time payments under arrangement made by the Puget Sound Power & Light Co., for the electrical contractors of its rural districts. Previous arrangement had made it possible for rural dealers to use E.H.F.A. terms on appliances but in March arrangements were completed to finance wiring also. Some 68 electrical contractors had signed up to make use of such financing.

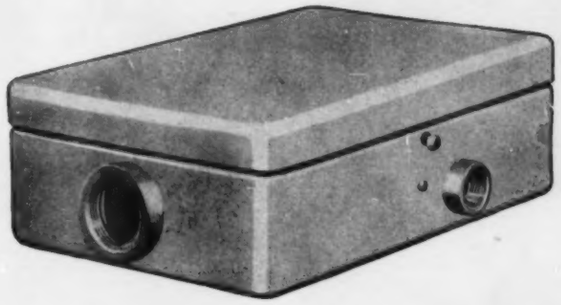
Under the plan the contractor gets his money within 24 hours after the contract is put through the E.H.F.A. office. The customer is billed by the power company on a separate post card bill which is issued simultaneously with his electric light bill. As a rule the payments are

FOLLOW TODAY'S TREND

Completely Streamlined Installations

with **WALKER**

Modern **Cutout and Junction Boxes**



No matter how up-to-date your materials, the job loses its neatness when old-fashioned, ugly cutout boxes are used. In this day when construction DEMANDS "streamlined" attractiveness in every job, you'll find Walker has the answer . . . cutout and junction boxes that are fully as modern as the rest of your equipment.

Here's why Walker boxes lead the field in ultra-modern durability and attractiveness:

- **No sharp edges or corners**
- **Concealed hinges**
- **Concealed Cadmium plated positive catch**
- **Extra heavy guage metal**
- **Rust proof finish**

Write for Catalog No. 3 Bulletin No. 3

WECO ATLANTA

WALKER
ELECTRICAL COMPANY
ATLANTA, GEORGIA

**REMOVE ONE CAP—
REPLACE THE LINK
—THAT'S ALL WITH**

**SHAWMUT
SHUR-LAG
RENEWABLE
FUSES**

ASK ABOUT THEM

The **CHASE-SHAWMUT COMPANY**

**NEWBURYPORT
MASSACHUSETTS**

In the News

[FROM PAGE 83]

made together. In addition to its value to the contractor, the appliance trade finds it of benefit wherever wiring is involved in installation of an appliance. The plan also applies for farm wiring.

COMPLETES 25 YEARS—On March 31st W. C. Field, Inspector of Wires for Springfield, Mass., celebrated a quarter century of service in municipal work. The city's inspector staff of three men is kept busy handling the daily routine, which includes inspections for a service modernization program now going on in the commercial area.

MODEL MUNICIPAL ORDINANCE

The I.A.E.I. Legislative Committee, composed of representatives of all groups of the industry under the chairmanship of V. H. Tousley, met in Chicago on May 9th. This group is preparing model forms for a municipal electrical inspection ordinance, for an ordinance to provide for the licensing of electrical contractors and for an electrical sales control ordinance. Recommendations are now before the I.A.E.I. Executive Committee for further action. NECA is represented on this joint 'Legislative Committee by George Andrae of Milwaukee.

HOME SURVEY LISTS WIRING NEEDS

Salt Lake City home owners recently indicated what they would want if they were to build again. The First Federal Savings & Loan Association mailed out questionnaires with a pamphlet "Changes We Would Make in Building Again." The returns indicated that a great many people regret their lack of adequate home wiring. Among some 112 changes named, are these electrical items:

41 per cent wanted more outlets in the living room.

8½ per cent wanted more in the dining room.

15½ per cent wanted an added electric light over the sink.

10 per cent wanted larger kitchens.

8½ per cent wanted more electrical outlets in the kitchen.

5½ per cent wanted electric lighting over the stove.

12½ per cent wanted more electric outlets in bedrooms.

4 per cent wanted more outlets in the bathroom.

Contractors will be able to use this pamphlet to persuade home builders to provide for greater adequacy.

ELECTRONIC DEVICES EXPLAINED TO MAINTENANCE ENGINEERS

A record turn-out of 160 electrical maintenance men and their friends heard R. H. Rogers, industrial engineer of the General Electric Company explain the application of electronic devices in industry before a regular meeting of the Chicago Electrical Maintenance Engineers on April 26.

Mr. Rogers devoted the introductory portion of his talk to the theory of operation of the various types of electronic tubes commonly used in industry. Then, with the aid of lantern slides, showed applications of the photo-tube, pliotron and kenotron.

Officers of the organization looked upon the record attendance as not only a personal tribute to Mr. Rogers but as a measure of the keen interest of electrical men in the subject of electronic control.

MANUFACTURERS NEWS

Westinghouse Promotions

Westinghouse Electric & Manufacturing Company has elected Marvin W. Smith a vice-president. He will direct all the company's engineering activities, with his office at East Pittsburgh, Pa.

F. R. Kohnstamm has been appointed sales manager of the Merchandising Division and L. E. Osborne as manager of Manufacturing Merchandising Division. Their headquarters will be at Mansfield, Ohio.

W. F. White has been made manager of the Lighting Division at Cleveland. He succeeds F. R. Kohnstamm.

United States Rubber Co. has appointed Willard H. Cobb as general manager of the Mechanical Goods and General Products Division. He was formerly general factory manager of the mechanical goods plants.

Graybar Appointments

Graybar Electric Company has appointed J. A. Mayer as assistant general power apparatus sales manager, reporting direct to G. K. Heyer.

H. G. Cook has been appointed manager of the Grand Rapids House.

A. L. Perry has been made Erie district manager.

The Okonite Company has opened a new district office in the National Building, 1404 East 9th Street, Cleveland, Ohio. F. J. Dahleiden, formerly a sales engineer in the Chicago territory, is in charge of this office.

Walter Geist was appointed vice president of the **Allis-Chalmers Manufacturing Company** at a recent meeting of the directors.

Harvey B. Jordan has been appointed vice-president of the **American Steel & Wire Co.** He will be in charge of operations and succeeds M. W. Reed, who has been made chief engineer for Carnegie-Illinois Steel Corp.

Emerson Electric Mfg. Company of St. Louis, announces the removal of its New York City district office to Suite 1945, 420 Lexington Avenue, New York.

Ajax Flexible Coupling Company of Westfield, New York, has appointed the Chicago Pulley & Shafting Company, 17 North Desplaines St., Chicago, as its distributor.

The Korfund Company, Inc. of Long Island City, New York has appointed the Dravo Corporation of Pittsburgh, Pa. as its agent in the Western Pennsylvania territory.

R. W. Cramer Company, Inc. has moved its general offices and factory from 67 Irving Place, New York City to Centerbrook, Conn.

Ward Leonard Electric Co. of Mount Vernon, N. Y., announces the appointment of C. B. Rogers, Zahner Building, 1000 Peachtree Street, N. E., Atlanta, Ga. as its representative for the sale of electric control devices. Mr. Rogers' territory will be the states of Georgia, South Carolina and North Carolina.

Badger

Synchronous ELECTRIC TIME SWITCH

For Real Profit

$ $ $ $ $ $

Complete dependability in operation is the quality that makes these Badger time switches really profitable for you. Wire 'em and forget 'em—they will give years of satisfactory service.

The complete Reliance line includes the BADGER, RELIANCE, RACINE and the MODEL W RELIANCE—a time switch for nearly every application. Write for full information.

RELIANCE AUTOMATIC LIGHTING COMPANY
1937 MEAD STREET
RACINE, WISCONSIN

For A. C. loads up to 50 amperes. Furnished in single and double pole types and in either cast iron or sheet steel cases. $18.00 and up. Underwriters' Laboratories approved

★

FLOOR BOXES AND WIRING SPECIALTIES

No. 252-R Two Gang Box

Two gang Adjustable Floor Box with No. 208 Receptacle in one section. One cover plate with ½" Flush Brass Plug and the other cover plate with 2" Flush Brass Plug.

No. 110 "Latrobe" Watertight Box

Cut-away view showing how tapered unit receptacle fits tapered opening in top of box body. The last word in design, appearance, and simplicity of installation.

The *Latrobe Line* is complete for all residential, commercial, and industrial requirements. In addition, the entire line is designed with the idea of reducing installation time . . . an important point to consider when selecting floor boxes and wiring specialties.

No. 284 Duplex Receptacle Nozzle

With ½" brass pipe extension. Neatest and most compact fitting obtainable. Also available with ¾" pipe extension. Fullman also offers Duplex Telephone Nozzles.

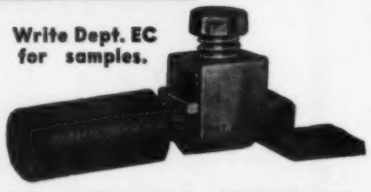
FULLMAN MFG. CO.
LATROBE • PENNA.

PROOF

Here's proof you can depend on ILSCO Solderless Lugs to grip wires securely — against as much as 480 LBS. PULL!

Capacity of scale used in test: 500 lbs. Lugs used same size as shown below, for #8 to #4 wire range.

Write Dept. EC for samples.



ILSCO COPPER TUBE & PRODUCTS, INC.
5629 Madison Road, Cincinnati, Ohio

Correct
for that MOTOR

• It's easy to pick out the correct capacitor for that refrigerator or other capacitor-type motor. Your refrigerator-parts jobber has the handy AEROVOX wall chart listing all standard motors and their capacitor replacements. And he has the correct AEROVOX unit in stock, so you won't lose valuable time.

•

Ask Your JOBBER...

He'll show you our wall chart. Also, he has our latest listing for your own shop use. Or write us direct.

AEROVOX
CORPORATION
NEW BEDFORD, MASS.
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More Gossip

Reward for Service

Political considerations too often block the chance of an electrical inspector finally becoming the chief. But Charles F. Armiger in Baltimore is an exception. With fourteen years service as deputy inspector, he became chief electrical installation inspector in April, 1939. With but twelve men on his staff, in this city of 817,000 population, local electrical contractors say that Chief Armiger is doing a good job.

A. L. STONE *of Los Angeles, executive committeeman for Division 9 of N.E.C.A., gave a résumé of the recent executive committee meeting to the joint meeting of all California contracting associations at Fresno, Apr. 22.*

Farm Adequacy

Farms have tight wires in many cases because the contractor doesn't try to talk adequacy, cites Frank M. Keinz, secretary of the Electrical Contractors Association of Utica, N. Y. A recent checkup of a $135 farm contract proposed for a rural customer was turned into a session on adequacy with the farmer. The result was a new layout that amounted to over $400. And the $135 man was not given the job.

Tough Ones Welcome

It takes the unusual job to test the mettle of J. A. Overmeyer of the Overmeyer Electric Company in Toledo. He recently moved 42 teletype machines and associated equipment between Saturday noon and Monday morning. It involved carrying circuits from the 13th to the 17th and back down to the 10th floor, a 12 circuit a.c. panel and a 4 circuit d.c. panel, two motor generator sets and all control equipment.

Because of the complex circuits involved, extreme care in marking and testing the circuits was necessary. But six men had completed the work and the 42 machines were in operation at 6:00 a.m., two hours ahead of the deadline.

Inspector Problem

"What constitutes safe salvage material?" asks W. C. Field, inspector of wires in Springfield, Mass. There come waves or cycles when a succession of jobs include second-hand service switches and other materials that were taken out of some other job. The inspector must rule on these products as fairly as possible, though should trouble develop he is responsible to the public for having given approval.

Home Wiring Publicity

The Electrical League of Milwaukee offers free an attractive illuminated house number, bearing the symbol of "Certified Wiring," to those who include adequate wiring in building new homes or in modernizing present homes.

Another "Largest"

To install the wiring for the largest plant of a certain class is worthy of note. This time it is A. Neri, Inc., Hoboken, N. J., electrical contractors. Several new buildings are now being wired for a food corporation in Hoboken to comprise what is said to be the largest coffee plant in the world.

Gang Up For A/W

The Electric League of Indianapolis recently ran a full-page ad featuring the "Electric Home Complete" in local Sunday newspapers. The layout pointed out fifteen major features of adequate wiring provided in this home. Most encouraging phase of this stunt, however, was to see the names of twenty-two contributing electrical contractors prominently listed at the bottom of the page.

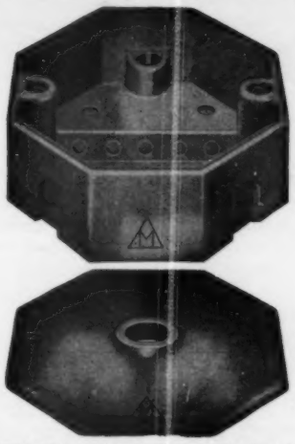
***ANTIQUE BI-POLARS,** vintage of 1882, were still giving good service in the shops of the Briner Electric Company of St. Louis until a few years ago, says Harry J. Martin, construction superintendent. These old time machines are Edison generators rated at 110 volts direct current. The machine in the foreground is 2½ kw and the other 1½ kw.*

Profit by USING

ILLINOIS

Dependable Porcelain

OUTLET BOXES



★Glazed and unglazed styles conforming to all existing standards of dimensions, spacing, position of knockout holes, and mounting screws. High mechanical and electrical efficiency.

Contractors who use these products not only establish themselves most securely with their customers but also build their business by making each job a true quality one. Send for bulletin.

ILLINOIS ELECTRIC PORCELAIN CO.
MACOMB, ILL.

RE-MO-LITE

LIGHTING UNIT

1 The only remote controlled lighting unit on the market.

2 Gives you simplicity and speed in wiring and maximum in profit.

3 Gives you big opportunity to meet rural needs as well as industrial.

Now give your customers the very best in lighting efficiency with convenience, comfort and safety.

It is controlled from a single wire service and is adaptable for any standard yard-light. Any number of switches can be used on the service. The price of the unit in comparison with the old three-way service for two-point controls, costs no more, and in many cases less. The control comes complete with two switches, lag bolts, service screws and instructions.

Write for bulletin to get complete information.

Twentieth

CENTURY ENGINEERING CO.
MANKATO, MINNESOTA

Razors to Big Motors

Buzzell Electric Works of Oakland, Cal., recently sent out a post card bearing the reprint of an editorial item from *Electrical Contracting* of November. It was about electric razors—and the need for outlets for shavers. Buzzell has a big motor shop and specializes in industrial work, but they call themselves—"an organization equipped to render a complete electrical service." So they act that way.

Fixture Heat

Inspectors, contractors and owners are still far apart in understanding where and how approved types of recessed lighting equipment should be installed, states Ralph W. Eaton of the Providence, R. I., inspection department. Labels of approval are based on a specific condition, whereas the job conditions may be entirely different, he says. Therefore, flush equipment needs labeling which explains whatever limitations apply to mounting it above the plaster or wall finish.

RUNS MODEL SHOP—Few shop operators enjoy the experience of having their plant just like they want it. But the case of Homer Hull is different. He manages the Jacksonville (Florida) Armature Works, a new shop, in new quarters laid out to Hull's own ideas. The layout is based on experience gained at the parent shop in Tampa.

Massed Maintenance

The Amoskeag Machine Co. of Manchester, N. H., is unique since it is the outgrowth of the old maintenance organization of the once-huge Amoskeag textile industries. When this business was divorced from the industrial organization, it had a payroll of 280, and now runs from 140 to 200 employees. Headed by Alfred H. Vose, former Amoskeag mechanical engineer, this unique organization serves the 60 odd smaller firms that now occupy some of the 100 Amoskeag buildings scattered along the Merrimack River. Mr. Vose operates machine and pattern making shops, handles millwright work, wiring, piping, carpentry, sheet metal and masonry work for present Amoskeag tenants, as an independent contractor.

G.E.

OFFERS

A FULL LINE OF

Tamper-resisting

TAMRES

PLUG FUSES

15, 20, 25, or 30 Amp

WITH REGULAR ADAPTERS OR LOCKING SPRING ADAPTERS

G-E TAMRES PLUG FUSES
CAT. NOS.
FUSES

15 amp—TR15 25 amp—TR25
20 amp—TR20 30 amp—TR30

ADAPTERS

For fuse TR15—Regular Adapter TR40; Adapter with locking spring TR41.
For fuses TR20, TR25 and TR30—Regular Adapter TR50; Adapter with locking spring TR51.

Now G-E Tamres tamper-resisting plug fuses are available with 15, 20, 25, or 30 amp capacity. These fuses will serve a dual purpose: (1) as a standard plug fuse without the adapter; (2) as a tamper-resisting plug fuse with the adapter. Adapters for these new Tamres Plug Fuses are available either with or without a locking spring. G-E Tamres Plug Fuses have standard medium Edison bases. They will fit any standard fuseholder or cutout.

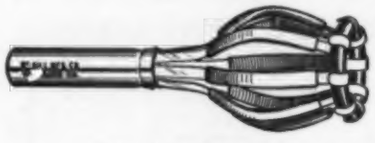
For further information, see the nearest G-E Merchandise Distributor or write to Section D-946, Appliance and Merchandise Department, General Electric Company, Bridgeport, Connecticut.

GENERAL ELECTRIC

EQUIPMENT News

Lamp Changer

The prong or finger-adjusting sleeve of the new improved McGill lamp changer is slipped up over the rubber-covered fingers sufficiently to grip the size of lamp you wish to handle. By pressing these fingers over the lamp, it may be removed or inserted by turning the pole. Coil spring grips lamp tightly. Flexible joint is furnished for smaller size lamp changer. By pulling cord, head is adjusted to any angle so lamps can be removed from or inserted in sockets in almost any position. Pole sections are 5½ feet long and fasten together with locking arrangement to make any length pole up to 30 feet. Available for use on a wide range of lamp sizes. McGill Manufacturing Co., Valparaiso, Ind.

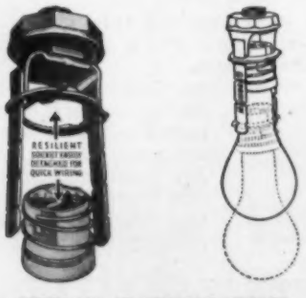


McGILL LAMP CHANGER

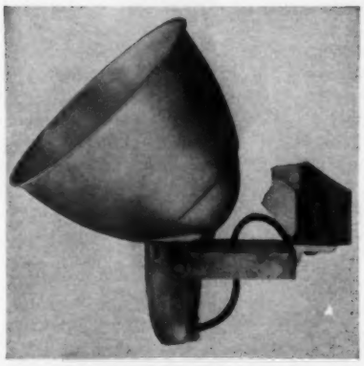
■

Adjustable Socket

This new adjustable socket provides vertical adjustment for proper positioning of lamps in reflectors. It has two slotted prongs. A slotted ring which holds a resilient spring-suspended socket completes the assembly. By compressing prongs, you can adjust socket vertically to four positions. Available in two sizes for medium or Mogul base and for keyless or pull-chain. Goodrich Electric Company, 2900 N. Oakley Avenue, Chicago, Ill.



GOODRICH ADJUSTABLE SOCKET



G-E. WIDE-BEAM FLOODLIGHT

Floodlight

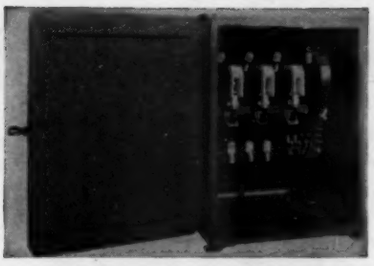
A wide-beam, open alzak-finish aluminum floodlight has been developed to meet floodlighting requirements of certain athletic fields, filling stations and parking lots. It is designed for use with 750/1000/1500-watt lamps and has a beam angle of 100 degrees. For floodlighting of baseball fields and other areas farther from the floodlight, narrow-beam floodlights should supplement this wide-beam unit. General Electric Co., Schenectady, N. Y.

■

OHMITE RHEOSTAT CONTROL

Rheostat Control

A rheostat designed to control the heat of soldering irons and soldering pots, cut costs on soldering operations, increase production, and save on soldering equipment maintenance cost. It prevents overheating, reduces accumulation of oxidation on soldering iron tip. It is mounted in a perforated metal cage, with knob and dial, series plug and six feet of rubber-covered cord, or unmounted with knob only for use on panel or with other equipment. Available in 6 ratings for irons or pots of 40 watts to 500 watts. Ohmite Manufacturing Co., 4835 Flournoy Street, Chicago, Ill.



WESTINGHOUSE LINESTARTER

Non-reversing Linestarters

New non-reversing linestarters for squirrel-cage and wound-rotor motors. Features of unit include low-voltage protection or release through low-voltage relay; bimetal type of overload relay; hand or automatic reset; saturated current transformers insuring adequate protection on slow starting applications; strong magnetic blowouts insuring adequate arc-rupturing capacity. Available in four sizes with 300, 600, 750, and 1200 ampere ratings. All ratings are two or three phase, three wire. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

■

JEFFERSON AUXILIARIES

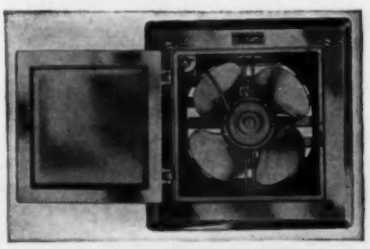
Fluorescent Lamp Auxiliaries

Jefferson has added a line of auxiliaries to meet the demands of the new type fluorescent high efficiency lamps. They are compact and small for easy, concealed installation in strips, channels and lamp fixtures. Coils inside metal case are machine wound and treated to remove and prevent absorption of moisture. Entire unit is sealed in all-weather resisting compound. Sizes are made for various fluorescent lamp capacities. Jefferson Electric Company, Bellwood, Ill.

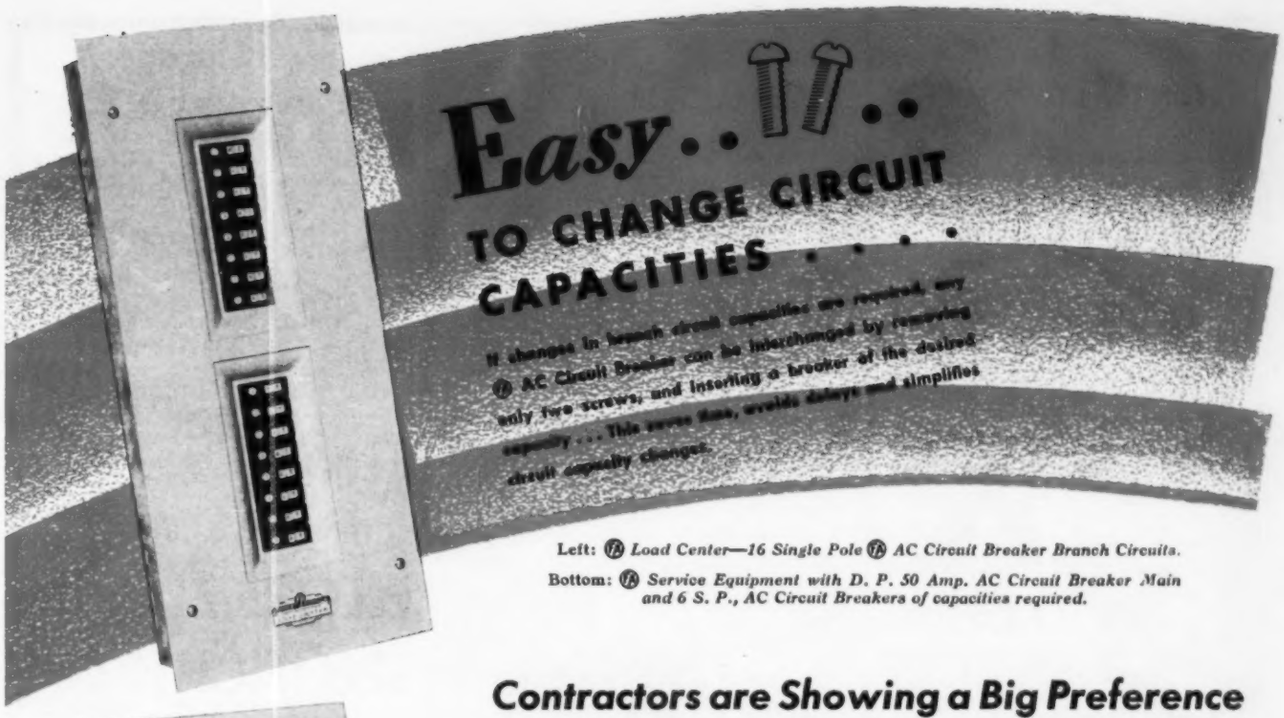
■

Kitchen Fan

An improvement in the signal line of automatic wall box kitchen vent fans. A baffle plate has been added to increase the efficiency of the fan and enhance its appearance. It provides greater air delivery by reducing turbulence around the fan blade. Signal Electric Manufacturing Co., Menominee, Mich.

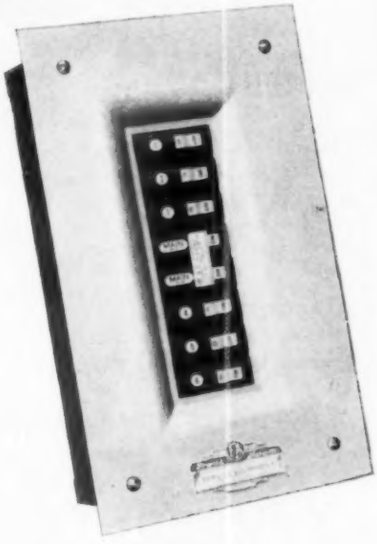


SIGNAL KITCHEN VENT FAN


Easy.. ..
TO CHANGE CIRCUIT CAPACITIES . . . .
If changes in branch circuit capacities are required, any (FA) AC Circuit Breaker can be interchanged by removing only two screws, and inserting a breaker of the desired capacity . . . This saves time, avoids delays and simplifies circuit capacity changes.

Left: (FA) *Load Center—16 Single Pole* (FA) *AC Circuit Breaker Branch Circuits.*

Bottom: (FA) *Service Equipment with D. P. 50 Amp. AC Circuit Breaker Main and 6 S. P., AC Circuit Breakers of capacities required.*



Contractors are Showing a Big Preference for this New (FA) AC Circuit Breaker Type

SERVICE EQUIPMENT AND LOAD CENTERS

Here's the popular equipment that's going over big with home owners . . . It's easy to sell — easy to install — and has many features of strong appeal:

Positive, automatic protection against short circuits and sustained overloads . . . No needless circuit interruptions when momentary overloads occur . . . No more "groping in the dark" to restore service . . . Merely return the handle to the "ON" position, after the cause of the short circuit has been removed . . . Operates manually, like an ordinary tumbler switch . . . Unusually attractive appearance . . . Fits on the job — easy to install . . . Ample wiring space . . . Priced right!

For 120 volt AC service . . . Capacities: 15, 20, 25, 35 and 50 Amp. . . . Approved by Underwriters' Laboratories . . . Send for New Bulletin No. 58 . . . Frank Adam Electric Company, St. Louis, Mo.

Stocks Near You

FOR IMMEDIATE DELIVERY

With building booming as it is, one of the most important features offered by (FA) is your assurance of immediate deliveries from Stock carried by your Distributor. Call him.

EST. 1891 THE SIGN OF A (FA) BETTER JOB

Frank Adam

SERVICE EQUIPMENT

AC CIRCUIT BREAKER TYPE

FRANK ADAM ELECTRIC CO.
ST. LOUIS, MO. U.S.A.

Easy!

Neat!

Perfect Joints!

MARR CONNECTORS

SEND FOR FREE SAMPLE

Approved by Underwriters

THE RATTAN MANUFACTURING CO.

552 STATE STREET
NEW HAVEN, CONN., U. S. A.

GENERAL SALES AGENTS HATHEWAY AND CO.
220 CHURCH STREET, NEW YORK, N. Y., U. S. A.

HERWIG

OUT-DOOR LIGHTING FIXTURES

Apartment Buildings
Public Buildings
Bungalows
Churches
Schools
Garages
Country Clubs
Warehouses
Residences

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EQUIPMENT NEWS

[FROM PAGE 88]

Voltage Transformer

A new constant voltage transformer supplying regulated a.c., is unaffected by line transients or chronic high or low voltages. Operating features consist of constant output voltage to within one per cent, from any input within the specified limits; uniformly high input power factor; low harmonic content; and high over-all efficiency. Regulation is automatic, instantaneous, continuous and dependable. It is self-protecting. Both transformer and associated circuits are protected against damage by accidental short circuits. Sola Electric Co., 2525 Clybourn Ave., Chicago, Ill.

SOLA VOLTAGE TRANSFORMER

■

Service Cable Head

This new service entrance cable head terminates the cable end in a fixed downward position, preventing entrance of rain and moisture through cable to both meter and testing equipment. Known as No. 202 it has the approval of the Underwriters' Laboratories. It is claimed to save on wiring time and initial cost is lower. Kwikon Company, 626 West Jackson Blvd., Chicago.

KWIKON SERVICE CABLE HEAD

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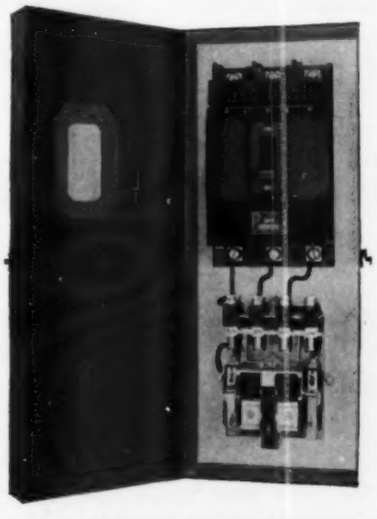
Type S403A timer has been designed to control operation of electrical equipment with a non-inductive load of 10 amps. at 110-volt, 5 amps. at 220-volt or motors up to 1 hp. single phase. It may be manually set to close circuit and will automatically break circuit at a predetermined time for any period from one-half hour to eleven hours. Con-Tac-Tor mercury switch used to make and break circuit is so designed that leveling by sight is sufficient in making installation. It is arranged for mounting on standard switch outlet box and provided with knock-out for wire mould or regular conduit so that either concealed or exposed wiring may be used. Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

MINNEAPOLIS-HONEYWELL TIMER

■

Motor Starter & Breaker

Type AP-7DB combination air motor starter and circuit breaker has an improved design. It consists of a standard AP-7 starter unit combined with an enclosed type air circuit breaker mounted in a metal case. Starter unit is suitable for 7½ hp., 550 volt motors or smaller units. Circuit breaker has an interrupting capacity of 5,000 r.m.s. amperes in 220 volt starters and 10,000 r.m.s. amperes in 440 and 500 volt starters. Circuit breaker is manually operated and trip free from handle. Provides short circuit protection while serving as a motor circuit switch. Use of air circuit breaker is desirable in locations where frequent overloads would necessitate continual replacement of fuses Allis-Chalmers Manufacturing Co., Milwaukee, Wis.



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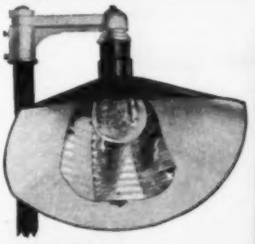

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Electrical Products Division
Ideal Commutator Dresser Company
1041 Park Ave. Sycamore, Illinois

EQUIPMENT NEWS

[FROM PAGE 91]

Electrode

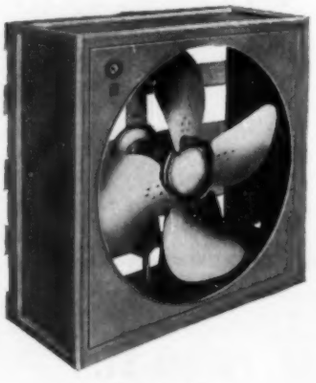
A new arc welding electrode for use with a.c. transformer type welders which have low open circuit voltage. Known as "Readyweld", it is a low-carbon steel rod with heavy, extruded, shielded arc coating possessing properties which assure arc stability and easy re-striking of arc with small low-voltage transformer welders. For general welding and repair work on light gauge sheet steel. Also operates with d.c. negative plants. Available in $\frac{5}{32}$-in. diameter, 12-inch lengths, packed in 25 pound containers. Weld metal possesses high strength and ductibility. The Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio.

LINCOLN ELECTRODE

■

Attic Fan

This attic fan has been improved in design for greater efficiency. Available in sizes ranging from 24-in. to 60-in. Finished in durable high quality enamel—frame work in light grey, blade in red. Some of the features are—external orifice for greater air delivery, perfectly balanced steel die cut, die formed blades, ball bearing motors and pillow blocks, specially constructed Kingston-Conley fan duty motors, thermal overload protection on all motors. Chelsea Fan & Blower Co., Inc., 370 West 15th Street, New York, N. Y.



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Transmissions

A new series of "Select-O-Speed" transmissions with hand wheel control. Supplements standard line from fractional to 7½ hp. capacity that are equipped with lever type control. Hand wheel is recommended where finer speed adjustments and smaller increments of speed are necessary. By turning wheel a partial turn, it is easy to change speed only a few revolutions per minute. By replacing hand wheel with set of beveled gears and extension rod and universal joint, point of control may be taken to a more convenient location. Ideal Commutator Dresser Co., 1041 Park Ave., Sycamore, Ill.

IDEAL SELECT-O-SPEED TRANSMISSION

■

Electric Hoist

This plug-in electric hoist known as "Comet" is a portable tool with heavy-duty construction. Powered by a specially built heavy duty, high torque motor that runs on an ordinary light circuit or 3 phase power line. Construction consists of precision ball bearings at each rotating point. Gears are precision machined of heat-treated alloy steel. Controller, with patented delayed reversing feature, operates with one hand. Brake is quick acting, positive, prevents drifting of load and is easily adjusted. Herc-alloy double-duty chain is strong and flexible, kink-proof. Available in four capacities—250, 500, 750 and 1,000 lb. and several speeds. Chisholm-Moore Hoist Corp., 288 Fremont Ave., Tonawanda, N. Y.

CHISHOLM-MOORE HOIST

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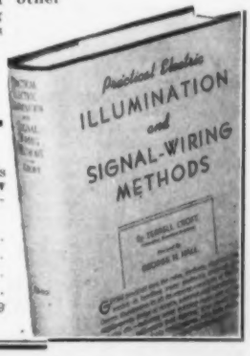

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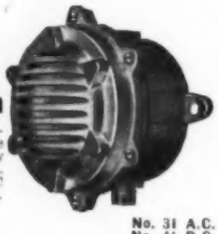

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Made in four sizes to connect wires from 2 #20 to 2 #2 B & S Ga.

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BATTLE CREEK MICH.

EQUIPMENT News

[FROM PAGE 93]

Fluorescent Wall Bracket

A wall bracket for decorative fluorescent lighting designed for hotel and theater lobbies, fitting and rest room mirrors, stores, cocktail bars and similar applications where color adds to the lighting scheme. Usually mounted in niches or on walls or pillars. Fixtures are finished in satin aluminum bronze lacquer with chromium plated trim consisting of vertical square rods and ornamental ends. Furnished completely assembled and wired, with reactance, less lamp. For 18-inch 15-watt lamp only. Wilson Lighting, Inc., 411 South Clinton St., Chicago, Ill.

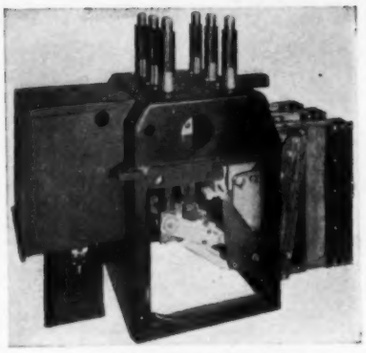
WILSON FLUORESCENT BRACKET

■

Fuse Clips

Fuse clips for cap sizes ¼-in. to 13/32-in. of beryllium copper, are designed to fill the need for a clip having high resistance to fatigue, heat and vibration in aircraft, portable tools, etc. Beryllium copper will withstand a vibration pressure of 35,000 to 40,000 lb. per square inch. Has a gripping strength about three times that of phosphor bronze and a wear resistance of five times that of phosphor bronze when used in fuse clips. Clips will withstand prolonged temperatures up to 200 deg. C. without losing tension. Standard finish is cadmium plate. Littelfuse Incorporated, 4238 Lincoln Ave., Chicago, Ill.

LITTELFUSE CLIPS



G.E. AIR CIRCUIT BREAKER

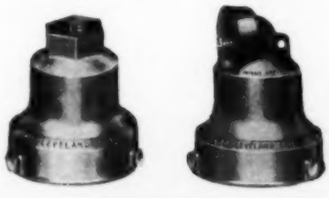
Air Circuit Breaker

A new air circuit breaker called "Magne-blast" for use with standard, vertical-lift type metal-clad switchgear. Designed for 5000-volt, three-phase service. When contacts part, the arc is magnetically driven into a specially constructed chute which confines and speedily interrupts the arc. When interruption occurs, the power factor at interruption is close to unity. Rate of rise of recovery voltage is only a fraction of inherent characteristics. Main contacts are silver-to-silver and arcing contacts of silver alloy. Studs of breaker are male ends of disconnecting devices and have silver contacts to eliminate periodic maintenance. General Electric Co., Schenectady, N. Y.

■

Weather-Proof Socket

The No. 3 and No. 4 weather-proof sockets are die-cast of Zamac Zinc, topped off with a coat of rust proof aluminum and can be used on both indoor and outdoor jobs. No. 3 is for vertical installations. No. 4, takes the pipe from the side at a 90 degree angle and has an extension on top with a hole so that wire may be used for reinforcing. Other features are—will not corrode, light weight, fits any standard 2¼-in. neck, approved porcelain socket. Spero Electric Corp., 18222 Lanken Ave., Cleveland, Ohio.



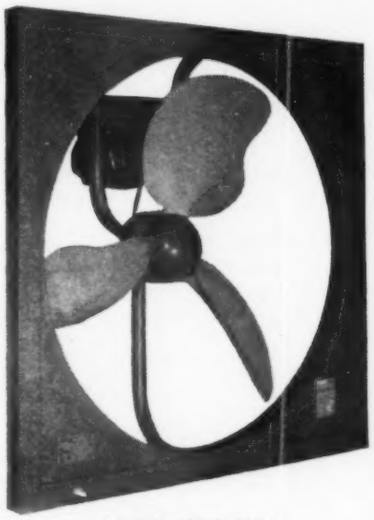
SPERO SOCKETS

■

Attic Fan

The "CirCOOLator" attic fan is suitable for homes ranging in size from six room cottages, of 7,500 cubic feet, to the larger home of 25,000 cubic feet. Available in three sizes having capacities of 7,500 cfm., 11,500 cfm. and 16,500 cfm. Has bullet-nose hub, which combines pulley, hub and bearing in one sealed assembly and

shaped blade of "Helixoid" design. Furnished with complete attic package kits which include all fittings needed for attic installation. Fittings include low resistance ceiling grille, trap door with automatic switch and fire link, vent-box with sound proof panelling and all ropes, pulleys, and fittings needed for installation. Viking Air Conditioning Corp., Main and Center Sts., N. W., Cleveland, Ohio.



VIKING ATTIC FAN

■

Field Rheostats

A new series of heavy-duty field rheostats designed for adjusting speed of motors in severe industrial service. Designated as type JM, it consists of a face-plate with contact arm and resistors of tube type assembled as a unit in a frame. Provides 60-point speed control. Vitreous-enamel-protected "Ribflex" and "Vitrohm" resistor tubes are assembled in frame of insulated tie rods attached to faceplate. Individual tubes may be removed and replaced, either for repair or to change characteristics of rheostat. Mounted in a wall-mounting sheet-steel enclosure with four bolts, so entire unit may be removed without disturbing any wiring or conduit. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

WESTINGHOUSE FIELD RHEOSTAT

2 New McGILL Guards
...with NEW utility features

No. 7060 — This McGILL Guard is an addition to the popular No. 7000 line. It is made in a smaller size to accommodate lamps from 25 to 60 watts. The cage, of extra-heavy steel wire, has all joints electrically welded. Handle is of highest quality black molded rubber. Four styles comprise this series and are available with or without reflectors, closed cages, lever or keyless sockets. No cam arrangement as in No. 7100.

No. 7100 — The fifteen McGILL Guards in this series differ from the No. 7000 line in that a wire collar supplants the flat band at the base of the cage. A cam arrangement (above) holds the cage to the hand-fitting, black, molded rubber handle instead of screws, making for easier and faster lamp changing without the use of any tools. Available with or without reflectors, closed cages, lever or keyless sockets.

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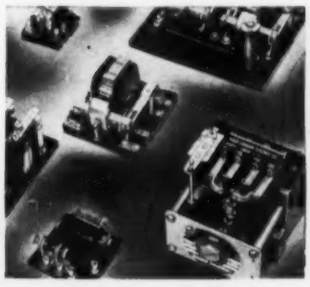

Line includes Heavy Duty, Intermediate, Light Duty and Sensitive Relays for time, temperature and pressure control.

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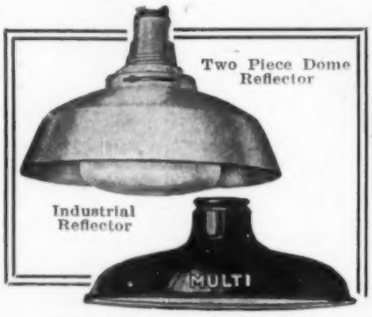

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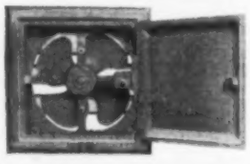

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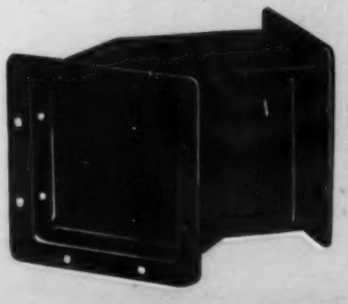
PROVES ITS CASE

..to a plant engineer!

SQUARE-Duct is available in one, two and five foot lengths —in three standard sizes, 2½"x2½", 4"x4" and 6"x6".

There are standard fittings to meet every installation requirement. Illustrated is T Fitting and Pull Box.



7½°, 22½°, 45° and 90° elbows are available for making turns or offsets to pass around pipes, beams, etc.

● When this plant was remodeled and modernized, SQUARE-Duct was used for power distribution, because—(1) the initial cost of SQUARE-Duct was about equal to conduit wiring; (2) the installation cost was substantially lower, and (3) SQUARE-Duct offers flexibility for the relocating of machines which is not obtainable with solid conduit. Knockouts every three inches make it possible to connect through short runs of conduit and, since SQUARE-Duct is installed at uniform height, it is often possible to re-connect the old conduit at another point.

A few weeks after SQUARE-Duct was installed, it proved its worth in a very tangible way. The chief electrician tells his experience:

"We wanted to install a small drill press at a certain spot. With solid conduit wiring it would have meant a long run of conduit and an installation cost in excess of the value of the machine. With SQUARE-Duct it only took us half an hour to tap in and make the electrical connections."

Any industrial plant can profit by the advantages of flexible power distribution which SQUARE-Duct affords.

CALL IN A SQUARE D MAN

SQUARE D COMPANY

DETROIT - MILWAUKEE - LOS ANGELES

IN CANADA: SQUARE D COMPANY CANADA LIMITED, TORONTO, ONTARIO

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GENERAL ELECTRIC